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Engineer Shortage?
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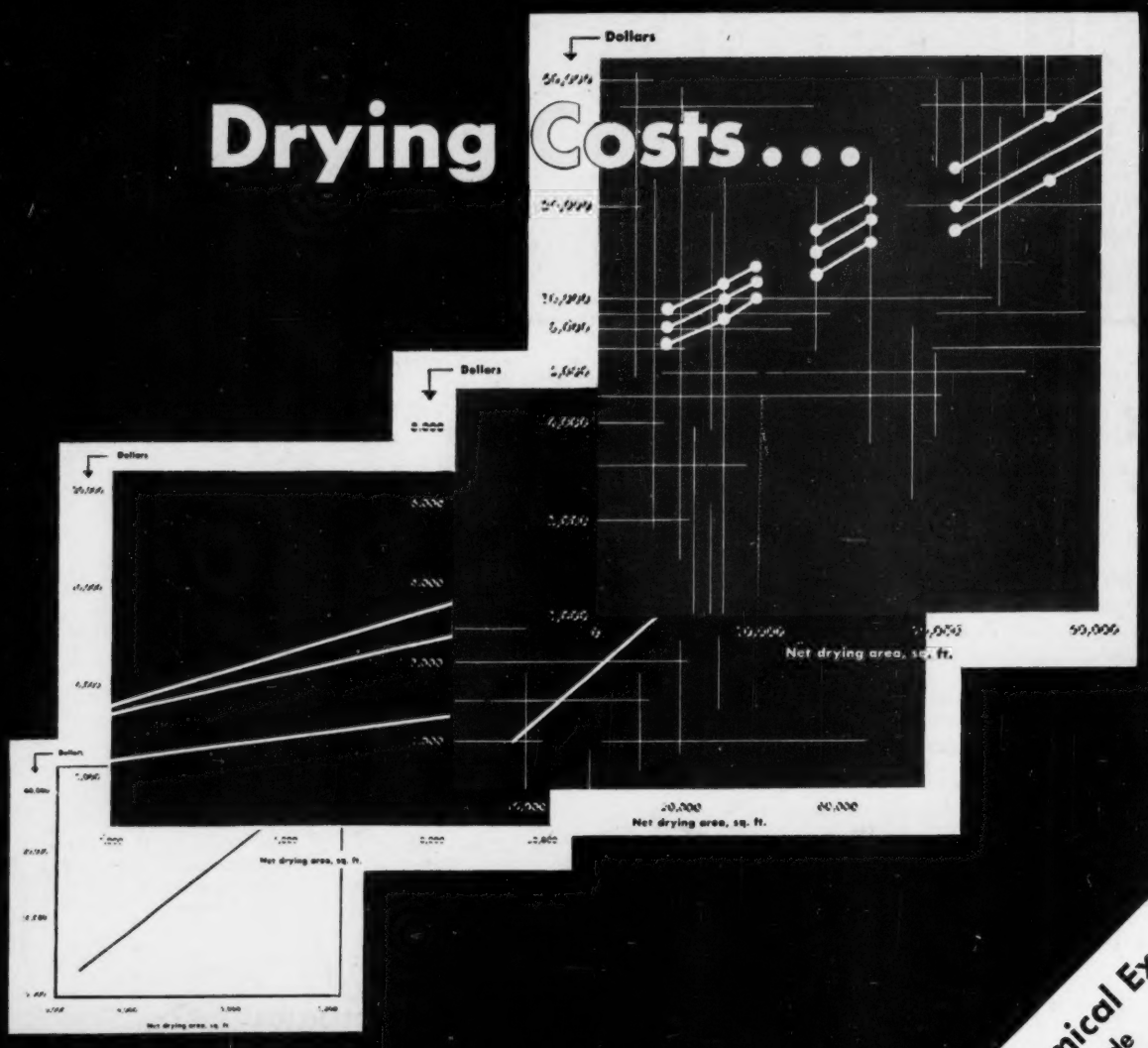
Chemical Engineering

NOVEMBER 1955

Drying Costs . . .



25th Chemical Exposition
Preview and guide
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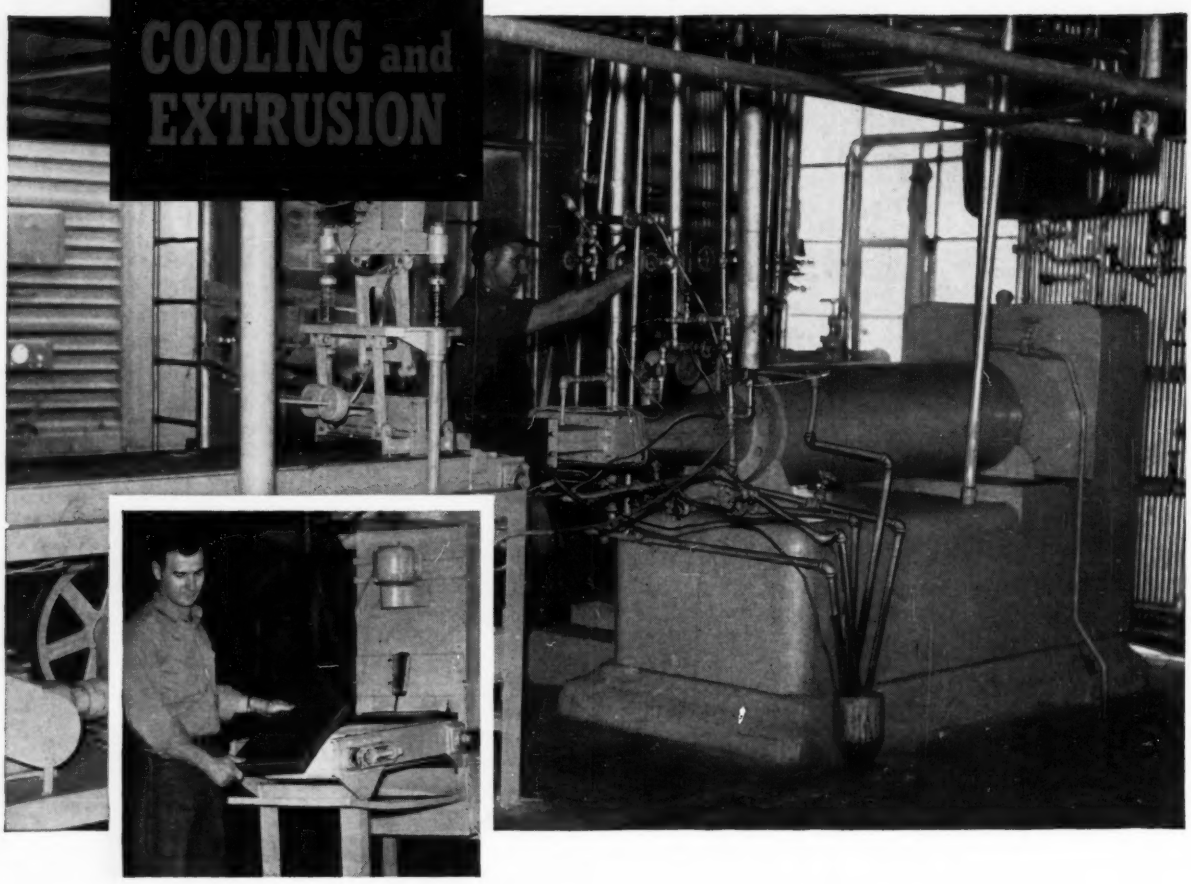
A McGRAW-HILL PUBLICATION

ONE DOLLAR

CONTINUOUS

COOLING and EXTRUSION



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WARWICK WAX COMPANY, INC., subsidiary of Sun Chemical Corporation reports the following benefits from modernization of wax-cooling with VOTATOR* Heat Transfer Apparatus (compared to former pan-cooling method):

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The VOTATOR Wax-Cooling Apparatus at Warwick cools the product from 220°F to 150°F and extrudes it into uniform 10-lb. slabs. Output is 3000 lbs. per hour.

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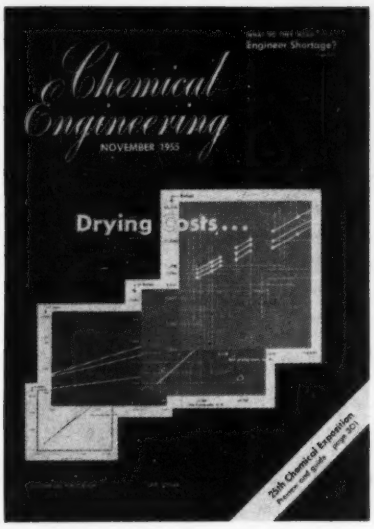
GUIDED TOUR

JOHN R. CALLAHAM, EDITOR



. . . Drying: Costs take the spotlight.

Tailored for design, development and production engineers, this month's feature report covers the thorny problem of picking, sizing and figuring costs of a drying system. Companion piece to last month's study of drying methods and equipment, this 24-page report helps you choose the best way of solving your drying problem. You'll find it packed with cost information and studded with correlations helpful in both preliminary and final designs. (p. 177)

Take a preview look at the Chem Show.

Next month's exposition will give you a first-hand look at what's new and useful. If you're going, save time with this floor plan and directory; if you're not, it's the next best thing to being there. (p. 305)

Here's where we come in.

Chemical technology will be starring in the fuels and energy picture before long. As demand mounts and supplies dwindle,

Please turn page

See You at the Chem Show!

For the next month you'll be hearing that expression mighty often.

For the "Chem Show"—this year it's the 25th Exposition of Chemical Industries—is the show of shows for chemical engineers.

The place: Philadelphia's Commercial Museum and Convention Hall. The time: Dec. 5-9.

Your guide: see p. 305 in this issue. What exhibitions are showing: p. 322. Booth locations: p. 310.

CE's editors will be there pretty much en masse, of course. And we hope you'll drop in to see us, to chat, to talk about an article idea, to discuss a new development, to tell us how we can do a better job—or just to sit down for a good rest! Our booth: No. 501, just opposite the main entrance.

But if you can't make this year's Show, here's a tip for you:

Watch CE's Process Equipment News section for factual summaries on the most important new developments at this year's Chem Show.—JRC

GUIDED TOUR

the chemical engineer will be challenged to hold costs down. (p. 201)

How to choose a tower tray.

This comparison of tray designs covers performance, limitations and costs of five different types. With it you can pick the proper design for any given distillation or absorption service. (p. 209)

What makes a good coating good?

It takes more than chemical resistance to make a coating protect. Check on its physical properties, too. If there's trouble, they're often the culprits. Corrosion Forum tells what to look for. (p. 242)

Some basic pointers on shaft seals.

To get top performance you should know how they work, their limitations and where to use them. With these fundamentals, you can select wisely from the growing number and types available. (p. 213)

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CHEMICAL ENGINEERING
November, 1955 Vol. 62—No. 11

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Chemical Engineering (with Chemical & Metallurgical Engineering) is published monthly with an additional issue in Mid-October by McGraw-Hill Publishing Company, Inc., James H. McGraw (1860-1948), Founder. Publication Office: 99-129 North Broadway, Albany 1, N. Y.

▶ **Executive, Editorial and Advertising:** 330 West 42nd St., New York 36, N. Y. Donald C. McGraw, President; Paul Montgomery, Executive Vice-President; Joseph A. Gerardi, Vice President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice President, Publications Division; Ralph B. Smith, Vice President and Editorial Director; Joseph H. Allen, Vice President and Director of Advertising; J. E. Blackburn, Jr., Vice President and Director of Circulation.

▶ **Subscriptions:** Write to Chemical Engineering—Subscription Service, 330 West 42nd St., New York 36, N. Y. Allow one month for change of address. Please show position and company connection on all orders.

Single copies $1 in U. S., Possessions and Canada; $2 in all other countries. U. S. and possessions, $3 per year, $4 for two years, $5 for three years; Canada, $4 per year, $6 for two years, $8 for three years; other Western Hemisphere and the Philippines, $15 per year, $25 for two years, $30 for three years; all others: $20 per year, $30 for two years, $40 for three years.

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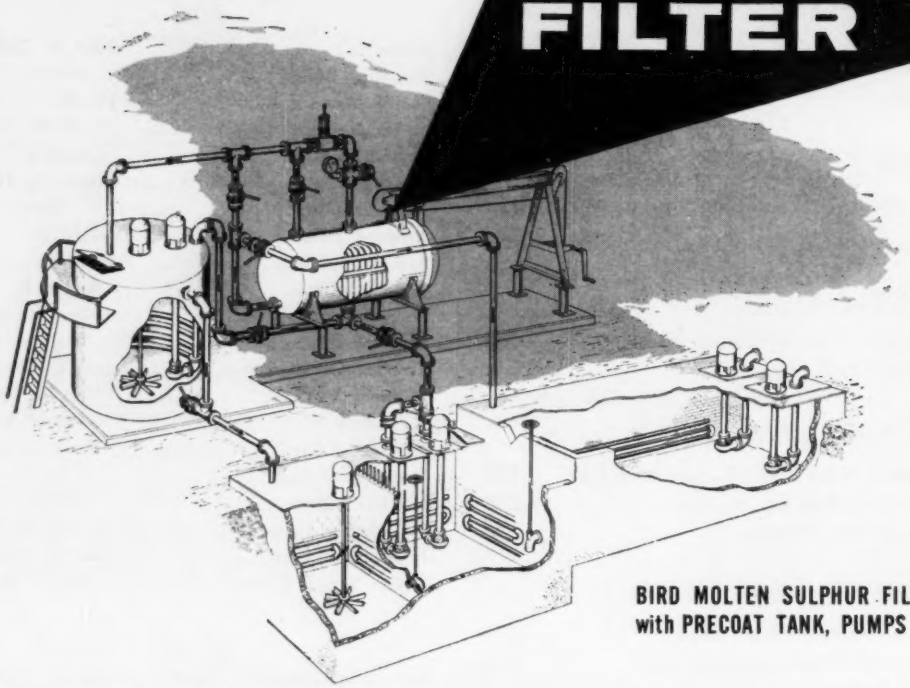
PRODUCTION "CATALYST"... the BIRD PRESSURE FILTER



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In manufacturing sulphuric acid, the presence of dirt in the molten sulphur causes frequent plant shutdowns for cleaning. Large settling tanks and other devices have not been able to reduce the impurities in the sulphur below 0.015 per cent ash content.

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The high capacity and high efficiency of the Bird Pressure Filter are boosting production and lowering operating costs in a constantly growing number and variety of applications.

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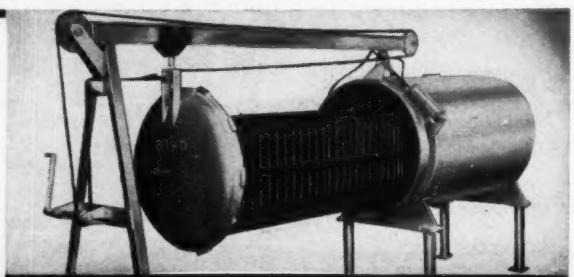

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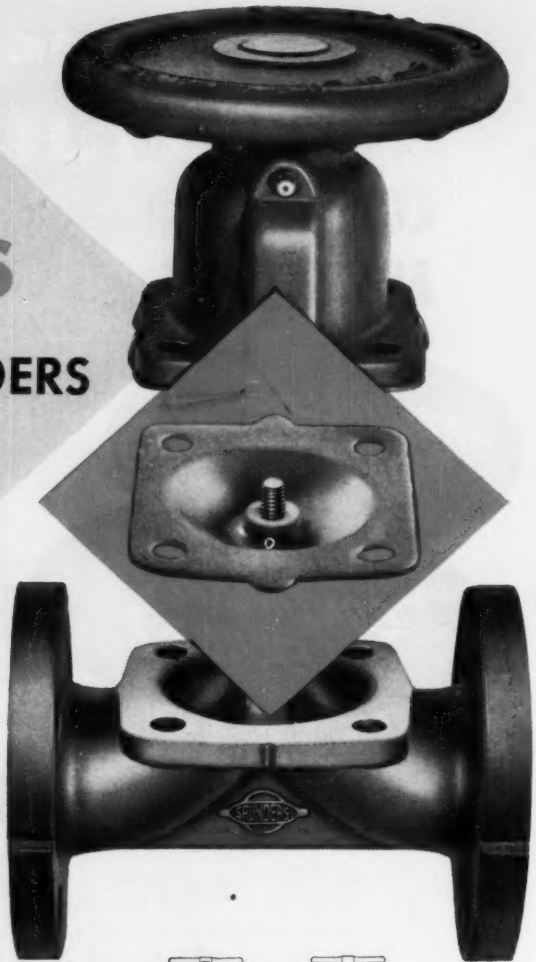

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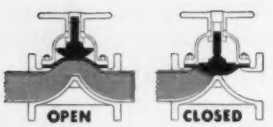

- Diaphragm lifts full height for streamlined flow in either direction
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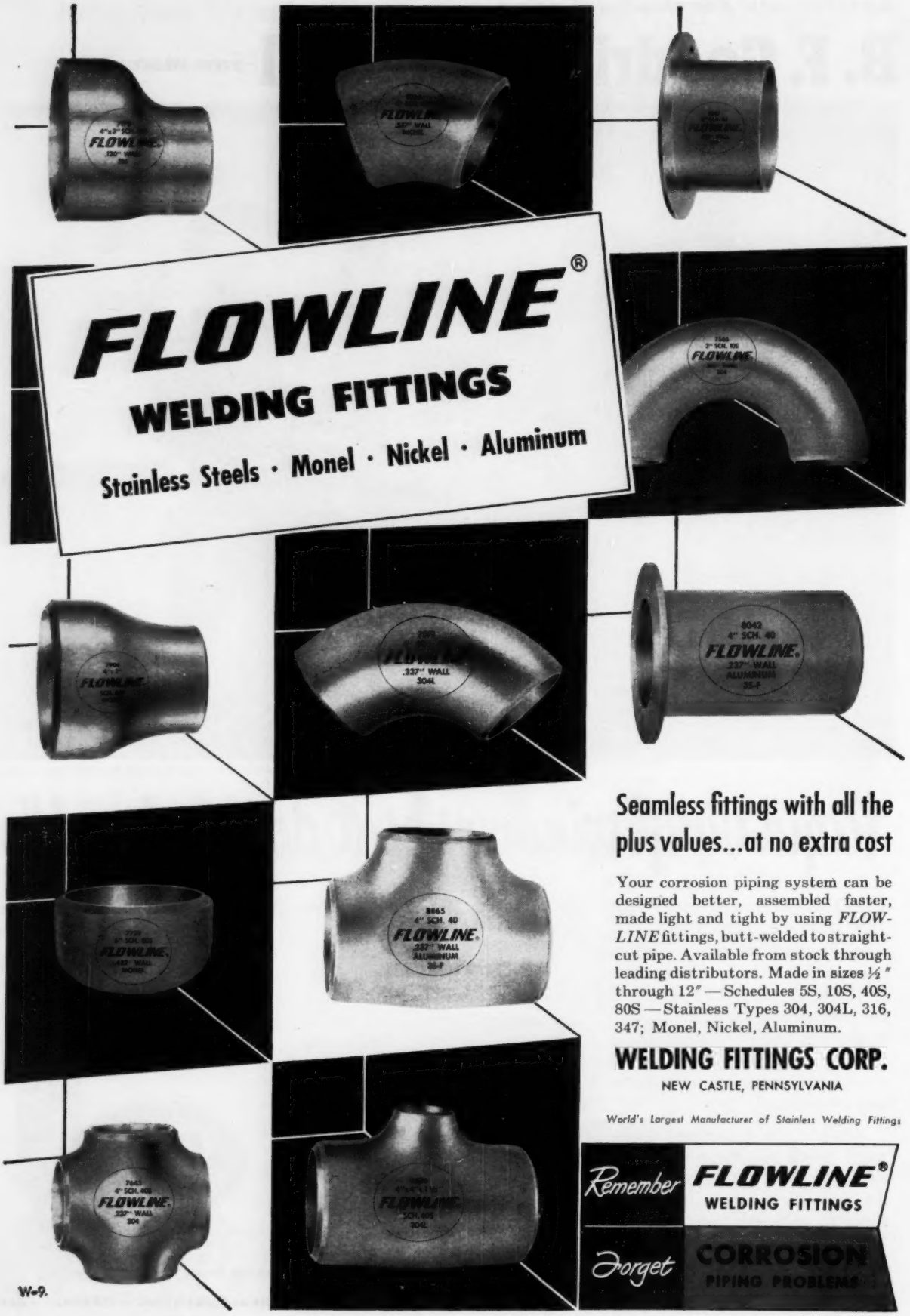

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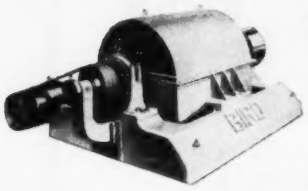
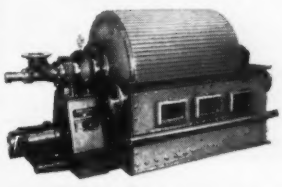
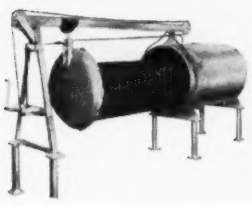


The BIRD CONTINUOUS CENTRIFUGAL FILTER— a full scale operating unit set up so you can look inside and see how it works to give you *thorough separation, high capacity, low operating and maintenance costs, continuously efficient and dependable operation* — all without filter media, vacuum or auxiliaries.

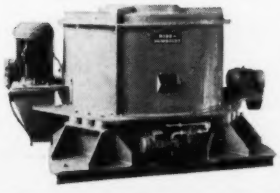


The BIRD-YOUNG CONTINUOUS ROTARY VACUUM FILTER with its ability to discharge very thin cakes with consequent high capacity; employing efficient multi-stage counter-current washing; and a design that permits the use of high vacuum at the filter media.

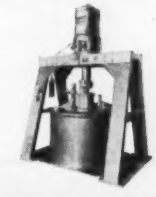


The BIRD PRESSURE FILTER, showing its exclusive design features — improved, extra strong leaves — maximum sustained filter area — rapid opening and cleaning — removable components for ready adjustment to varying needs *and the new self-sealing filtrate manifold that simplifies piping and puts all operating controls in one convenient place.*

The NEW BIRD-PRAYON CONTINUOUS, ROTARY, HORIZONTAL VACUUM FILTER — a working model that demonstrates how this pan-type filter combines efficient, multi-stage, counter-current washing of solids with high separating efficiency and low operating cost *continuously* without shutdowns for cleaning.



The NEW BIRD-HUMBOLDT SCREEN TYPE CENTRIFUGAL DRYER, showing you how it combines high frequency oscillation and centrifugal force to deliver a continuous flow of well dewatered solids with *low power consumption* and *long screen life.*



The BIRD SUSPENDED CENTRIFUGAL with its famous *Gyro-Balanced Suspension Head* for smooth operation with out-of-balance loads, and the construction features that have made it first choice for heavy duty, high capacity batch separation and clarification.

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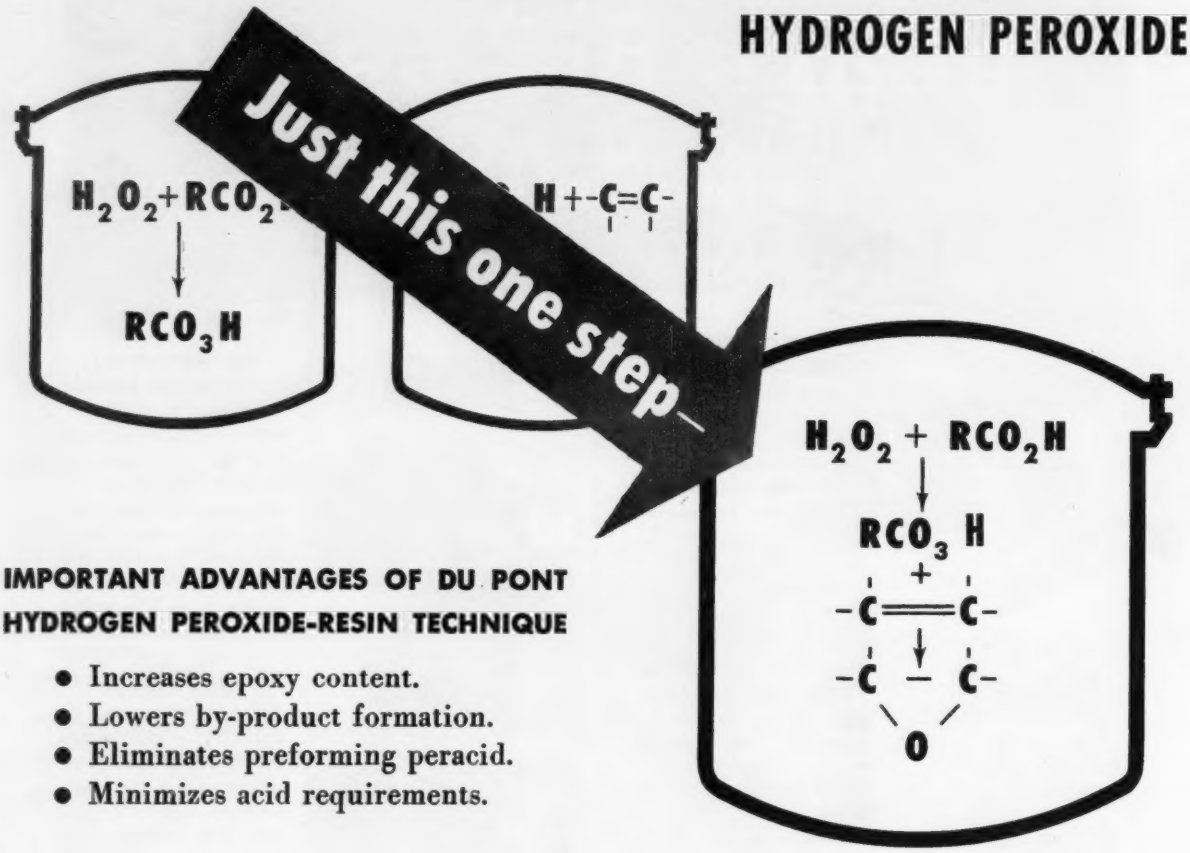

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- Minimizes acid requirements.

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In addition to its use in the new field of epoxidation, "Albone" hydrogen peroxide is relied upon to improve a wide variety of products and processes. Its powerful oxidizing action, for example, is important in organic synthesis . . . where it splits the aromatic ring, initiates polymerization and forms aromatic quinones. High purity syntheses are assured because water is the only by-product of efficient operation.

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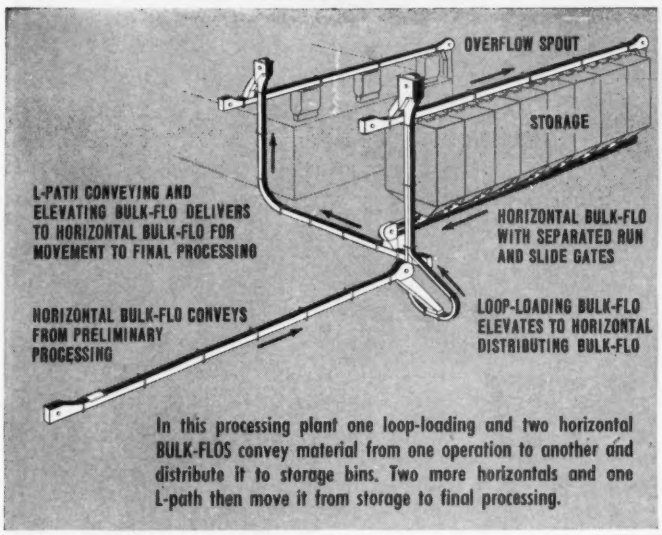
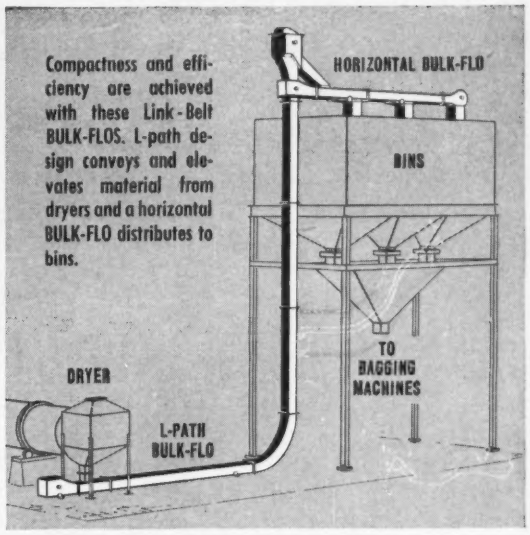
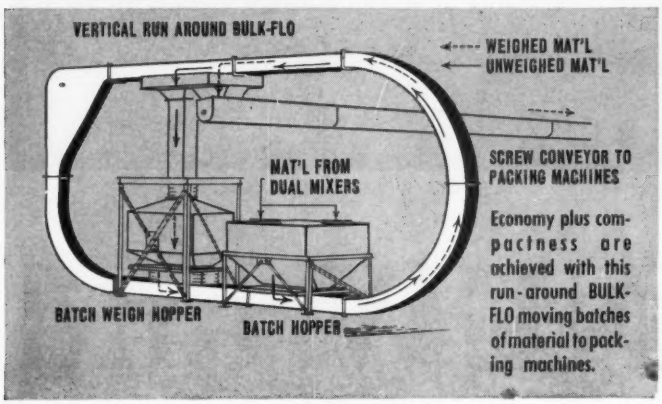
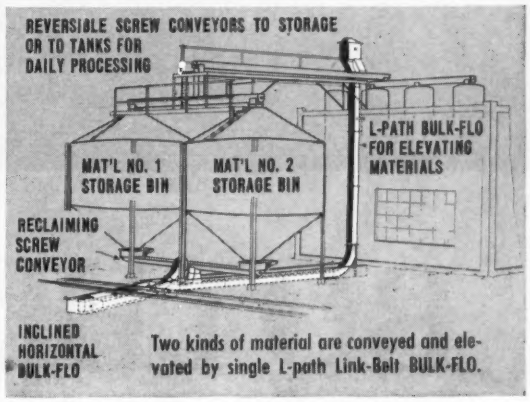

OVERFLOW SPOUT
STORAGE
L-PATH CONVEYING AND ELEVATING BULK-FLO DELIVERS TO HORIZONTAL BULK-FLO FOR MOVEMENT TO FINAL PROCESSING
HORIZONTAL BULK-FLO WITH SEPARATED RUN AND SLIDE GATES
HORIZONTAL BULK-FLO CONVEYS FROM PRELIMINARY PROCESSING
LOOP-LOADING BULK-FLO ELEVATES TO HORIZONTAL DISTRIBUTING BULK-FLO
In this processing plant one loop-loading and two horizontal BULK-FLOS convey material from one operation to another and distribute it to storage bins. Two more horizontals and one L-path then move it from storage to final processing.


Compactness and efficiency are achieved with these Link-Belt BULK-FLOS. L-path design conveys and elevates material from dryers and a horizontal BULK-FLO distributes to bins.
HORIZONTAL BULK-FLO
BINS
TO BAGGING MACHINES
DRYER
L-PATH BULK-FLO

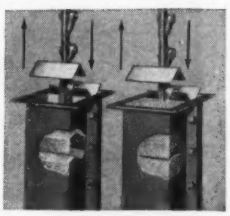

VERTICAL RUN AROUND BULK-FLO
WEIGHED MAT'L
UNWEIGHED MAT'L
MAT'L FROM DUAL MIXERS
SCREW CONVEYOR TO PACKING MACHINES
Economy plus compactness are achieved with this run-around BULK-FLO moving batches of material to packing machines.
BATCH WEIGH HOPPER
BATCH HOPPER


REVERSIBLE SCREW CONVEYORS TO STORAGE OR TO TANKS FOR DAILY PROCESSING
L-PATH BULK-FLO FOR ELEVATING MATERIALS
MAT'L NO. 1 STORAGE BIN
MAT'L NO. 2 STORAGE BIN
RECLAIMING SCREW CONVEYOR
INCLINED HORIZONTAL BULK-FLO
Two kinds of material are conveyed and elevated by single L-path Link-Belt BULK-FLO.

Single, compact, enclosed assembly . . . operates fully or partially loaded

SHOWN above are four of many handling variations possible with Link-Belt BULK-FLO. This single assembly moves materials along horizontal, vertical and inclined paths . . . combines feeding, conveying, elevating. Flexible, compact and sanitary—BULK-FLO often replaces several handling units—in less space . . . at lower cost. Get complete information from your nearby Link-Belt office or send coupon for your copy of Book 2475 today.

SEE OUR EXHIBIT—NATIONAL CHEMICAL EXPOSITION—PHILADELPHIA—DECEMBER 5-9



FULL OR PARTIALLY LOADED—Link-Belt BULK-FLO assures positive, gentle movement of material. Self-clearing through intermediate runs, it prevents contamination.

LINK-BELT

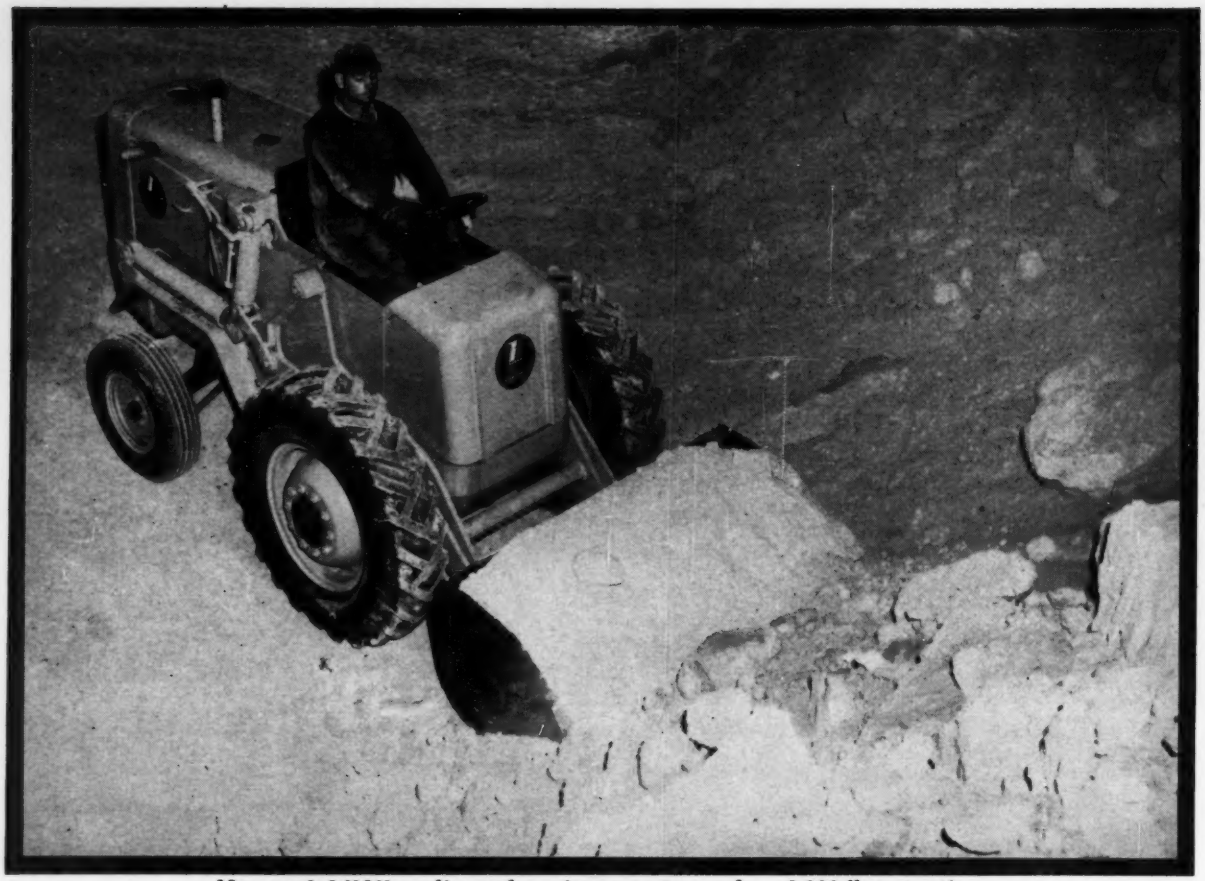
BULK-FLO FEEDERS • CONVEYORS • ELEVATORS

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World. 13,678

LINK-BELT COMPANY
307 N. Michigan Ave.
Chicago 1, Ill.
(Or your nearest Link-Belt office)

Please send me a copy of your 28-page BULK-FLO Book 2475.

Name .....
Firm .....
Address .....
City ..... Zone .... State .....



New **model HAH** — digs and carries up to 1 cu. yd. or 3,000 lbs. at a time.

BOTH NEW and

DIGGING POWER

3,000 lbs. and 4,500 lbs. of tractive thrust, plus powerful upward rotation of bucket by twin hydraulic rams, develop tremendous digging power.

40° BUCKET TIP-BACK

Bucket tips back 40° on its hinges before it is even lifted — to get heaped bucket-loads quickly and prevent loss due to spillage.

CARRYING CAPACITY

40° tip-back also brings loaded bucket back close to machine *and low* for safe, fast transport.

SAFETY-STABILITY

Bucket arms and other moving parts are mounted and positioned low where they are no hazard to operator's limbs.

New **model HA** — digs and carries up to 18 cu. ft. or 2,000 lbs. at a time.

More Productive

Hough, the pioneer and leader in the tractor-shovel industry, is pleased to present these all-new "PAYLOADER" units. Both have front-wheel-drive and rear-wheel-steer — especially designed for stockpile work and fast material moving in close quarters. They give you a choice of sizes to best fit your requirements — they're the finest of their type in Hough history — they're both way ahead of the field in design, performance and all-round value.

Your Hough Distributor is eager to show what these new machines can do for you. The Frank G. Hough Co., 703 Sunnyside Ave., Libertyville, Ill.

OTHER FEATURES of these outstanding new models include: torque converter drive; full-reversing transmissions; closed, pressure-controlled hydraulic system; large hydraulic brakes; accumulator in hydraulic system that prevents pressure shocks and facilitates bucket control.

PAYLOADER®
MANUFACTURED BY
THE FRANK G. HOUGH CO. LIBERTYVILLE, ILL.
SUBSIDIARY—INTERNATIONAL HARVESTER COMPANY

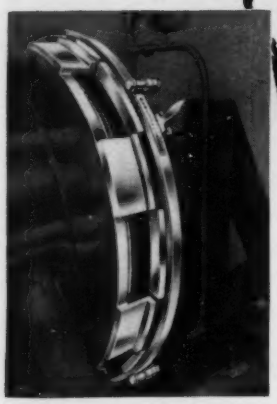
THE FRANK G. HOUGH CO.
754 Sunnyside Ave., Libertyville, Ill.

Send data on "PAYLOADER" units
Model HA ☐ Model HAH ☐ larger sizes ☐

Name.....
Title.....
Firm.....
Street.....
City..... State.....

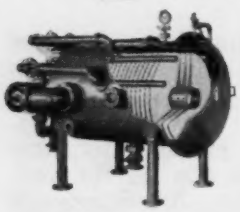
See the newest developments in

Sparkler Filters

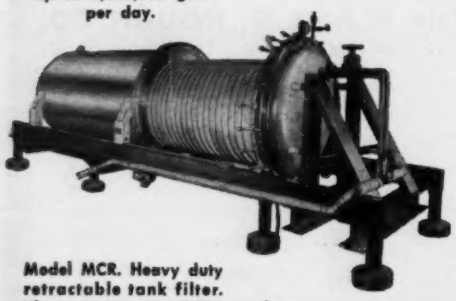


Passalaqua Speed Lock Cover (ASME Approved)

Standard Horizontal Plate Filter



Model SCJ. Large volume water filter. Single unit capacity up to 5,000,000 gal. per day.



Model MCR. Heavy duty retractable tank filter. Plate area up to 2,000 sq. ft.

Displayed and demonstrated will be the new Sparkler-Passalaqua Speed Lock Cover (ASME Approved); Sparkler Filters, Model MCR; Model SCJ; Standard Horizontal Plate Filter (Cut-away Model); Model VR and others.

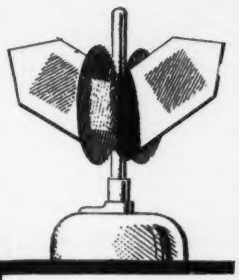
New ideas on filtration will be presented that are of particular interest to Chemical Engineers.

SPARKLER
MANUFACTURING CO.
MUNDELEIN, ILL.

Filtration engineering and manufacturing exclusively for over 30 years.

FOR GREATER TANK CAR VALUE—

Switch to DURADOME!



When you switch to the revolutionary new DURADOME tank car . . . designed and built by ACF — you get these important benefits at *no extra cost!*

1. Much easier cleaning
2. Far greater structural strength
3. Better application of lining
4. Increased insulating efficiency

Whatever your tank car requirements are — contact your Shippers' representative about leasing or buying the new DURADOME. He'll give you the facts about DURADOME's superior *pressure-type construction, standardized underframe, all-welded insulation jacket* and the many benefits of the advanced *flued dome design.*

Specialists for over 35 years in the leasing, operation, maintenance and servicing of tank car fleets — also exclusive sales agent of ACF tank cars for industry.

SHIPPERS CAR LINE — SHPX

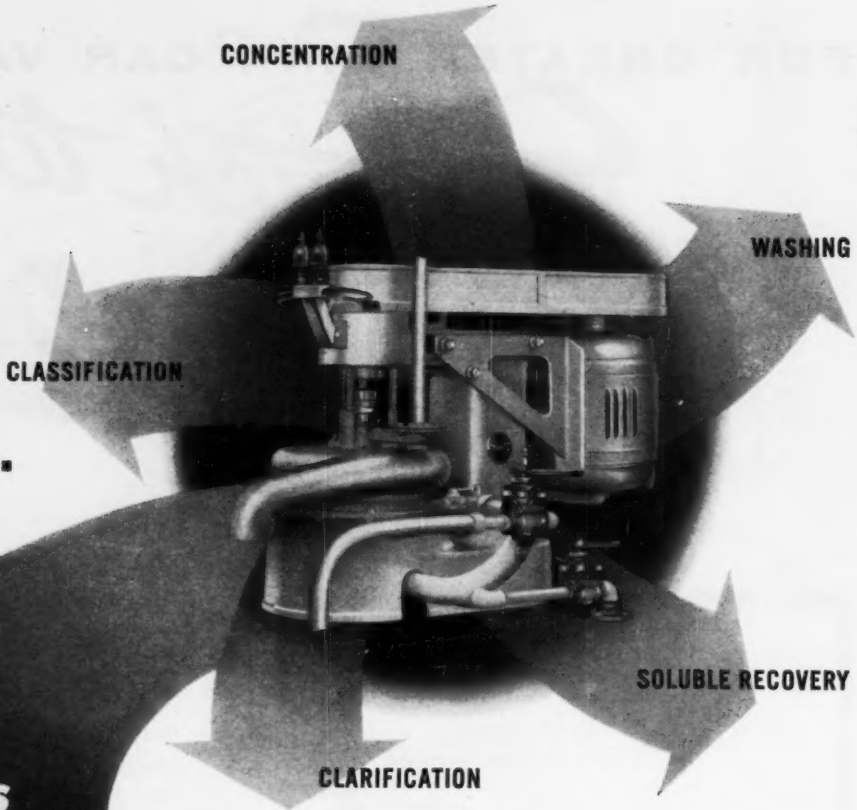
Shippers' Car Line Corporation

A subsidiary of ACF INDUSTRIES, Incorporated

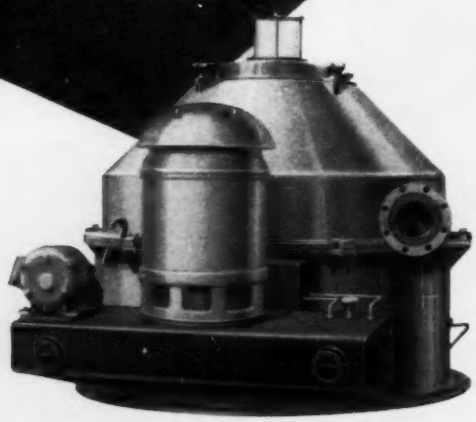
30 Church Street, New York 7, N.Y.

CHICAGO, ILL. • HOUSTON, TEX. • SAN FRANCISCO, CAL. • MILTON, PA. • EAST ST. LOUIS, ILL. • SMACKOVER, ARK. • TULSA, OKLA. • NORTH KANSAS CITY, MO.

5 basic MERCO continuous separations...



...plus de-watering



THE MERCONE

This new centrifugal screen is a completely continuous separator. The Mercone can be used to de-water crystals and fibers, to segregate or classify pulps, or to separate slurried solids of different types. The combination of design simplicity and high operational efficiency makes the Mercone the ideal solution to many process problems.

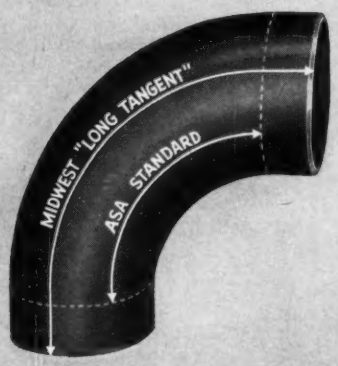
Merco Centrifugal Separators and Mercone Centrifugal Screens assure fast, efficient, economical, and fully continuous operation.

Write for details or see us at Booth #2 at the National Chemical Exposition.

MERCO CENTRIFUGAL CO.
AFFILIATE OF THE MERRILL COMPANY
150 GREEN STREET • SAN FRANCISCO • CALIFORNIA

MERCONE

THESE MIDWEST "LONG TANGENT" ELBOWS SAVED $4121 IN PIPE



MIDWEST "LONG TANGENT" ELBOWS COST NO MORE THAN OTHER ELBOWS

Here are 1227 Midwest "Long Tangent" Elbows (12″, 14″ and 16″ standard weight) ready for shipment to a chemical plant. Each Midwest "Long Tangent" Elbow has a straight section on each end equal in length to ¼ the nominal pipe size. Thus a 12″ elbow saves 6″ of 12″ pipe while a 16″ elbow saves 8″ of 16″ pipe. It doesn't take long to save a lot of pipe and a lot of money . . . in this instance $4121.

But saving pipe is not the only advantage of Midwest "Long Tangent" Elbows. They often eliminate short nipples and their extra welds . . . save time and money in lining up and clamping pipe and fittings . . . slip-on flanges are more easily applied. For all the facts, write for Catalog 54.

MIDWEST PIPING COMPANY, INC.
Main Office: 1450 South Second Street, St. Louis 4, Mo.
Plants: St. Louis, Passaic and Los Angeles

Sales Offices
New York 7—50 Church St. • Chicago 3—79 West Monroe St.
Boston 27—426 First St. • Los Angeles 33—520 Anderson St.
Houston 2—1213 Capitol Ave. • Tulsa 3—224 Wright Bldg.
Cleveland 14—616 St. Clair Ave. • Miami 34—2103 Le Jeune Rd.
STOCKING DISTRIBUTORS IN PRINCIPAL CITIES

MIDWEST WELDING FITTINGS

MIDWEST WELDING FITTINGS Improve Piping Design and Reduce Costs

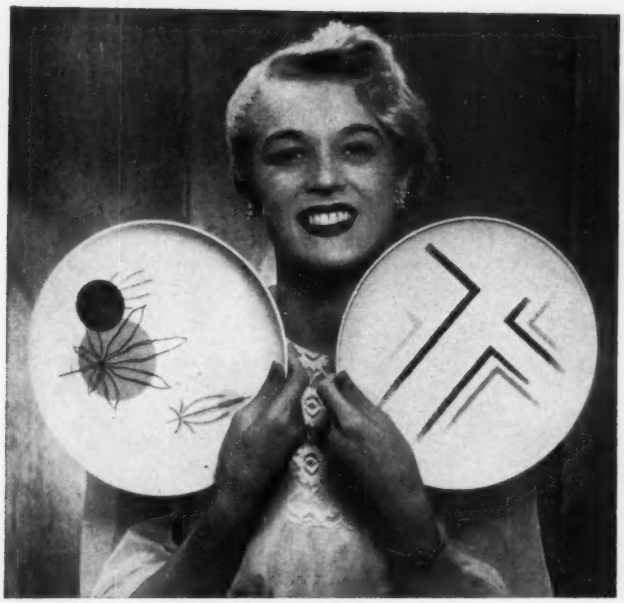
7055

Life on the Chemical Newsfront

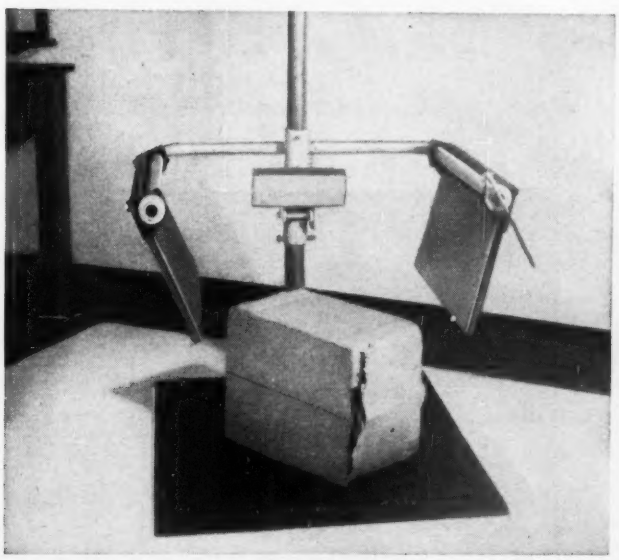
CYANAMID HAS RECENTLY RESEARCHED two new color-stable types of Phthalocyanine blue pigments to solve the problem of color drift in automotive finishes. The new red shade Cyan Blue Toner BNF 55-3750 and the green shade Cyan Blue Toner GT–NF 55-3450 have the unique physical properties of being both flocculation-resistant and crystal-stable in automotive finishes. So now, regardless of application techniques, uniform color and depth are easily obtained on both original and refinishing coatings. **(Pigments Division)**

UNDERWEIGHT INFANTS now may have their appetites stimulated and rate of growth increased by a new preparation known as INCREMIN® Lysine-Vitamin Drops. Developed by the Lederle Laboratories Division of Cyanamid, INCREMIN is a combination of a vital growth-stimulating amino acid and the necessary vitamins. Based on extensive research in human nutrition, INCREMIN is prepared as a cherry-flavored liquid and packaged in an unbreakable "squeeze" bottle for easy dispensing. Effective for infants, INCREMIN also may be used for elderly persons who do not have sufficient zest for their food. **(Lederle Laboratories Division)**

PACKAGED MEAT, FISH AND FROZEN FOODS keep fresher longer when the cellophane wrap is coated with ACCOBOND® 3900 Resin before waterproofing treatment. The cationic nature of ACCOBOND 3900 helps to produce strong adsorption to cellophane and exceptionally high bond strength between cellophane and the nitrocellulose waterproofing coating. A new and simple test method, developed by Cyanamid research, gives rapid evaluation of bond strength and better control of the cellophane coating process. For details of the new test write on your letterhead. **(Industrial Chemicals Division, Department B)**



A NEW LOOK now can be given thermosetting plastic products with colored decorations molded into the top surfaces. The dinnerware pictured above is molded of Cyanamid's Melamine Molding Compound No. 1077. The decorative paper overlay is impregnated with Cyanamid's Melamine Resin No. 405. Known as a "foil," the overlay can be printed with special inks in any number of colors. It is inserted in the mold during the breathing or de-gassing phase of the molding cycle. Heat and pressure fuse the impregnated foil and the molding compound into a homogeneous mass. Many other possible applications can be envisioned: decorative door knobs, gift boxes, closures, wall tiles and cosmetic containers. **(Plastics and Resins Division)**



NEW PERFORMANCE RECORDS for paper packaging materials such as the carton shown in the "drop-test" above, may be established by fortification with Polyacrylamide of the conventional adhesives used in carton construction. The addition of small amounts of Polyacrylamide increases the strength and durability of the adhesive bond. It also provides high initial tack and unusual spreadability. As a result, packages are stronger and more resistant to the wear and tear they encounter in transit. Polyacrylamide is a white, odorless powder, readily soluble in cold water, and it does not decrease in solubility with increase in temperature. The remarkable properties of Polyacrylamide make it suitable for a wide range of industrial applications. **(New Product Development Department)**

News Briefs

IMPROVED PERFORMANCE IN COLORED PAPERS is made possible with CALCOTONE* Pigment Pastes. Full color value is developed with CALCOTONE Pigment Pastes because their fine particle size and compatibility with paper additives assure excellent dispersion of the color in the beater. The CALCOTONE Pigment Pastes also have outstanding lightfastness and chemical stability. Better color results are obtained on all grades of paper ranging from tissues to heavyweight board. **(Organic Chemicals Division)**

MORE EFFICIENT PURIFICATION OF MUNICIPAL WATER has been obtained by replacement of dry alum with special liquid alum. The use of liquid alum reduces labor costs in handling and storage. Also, liquid alum can be fed continuously to the raw water at an accurate rate by metering devices, thus eliminating operation and maintenance of the dry feed machine. With the new liquid alum, savings of almost 10% have been reported in large-scale municipal water purification operations. **(Industrial Chemicals Division, Department B)**

ACCONOX* FEED SUPPLEMENT, the first antioxidant premix offered to feed manufacturers, keeps feeds appetizing longer by deterring rancidity which develops in feeds during storage. It eliminates the unpleasant smell and taste in feed by retarding oxidation. Also, it conserves vitamins A and E, thus helping to prevent deficiency diseases. ACCONOX 25 is a special blend of butylated hydroxyl toluene. It does not dust, cake, or cling to mixing equipment, thereby assuring even distribution in the mixing operation. **(Fine Chemicals Division)**

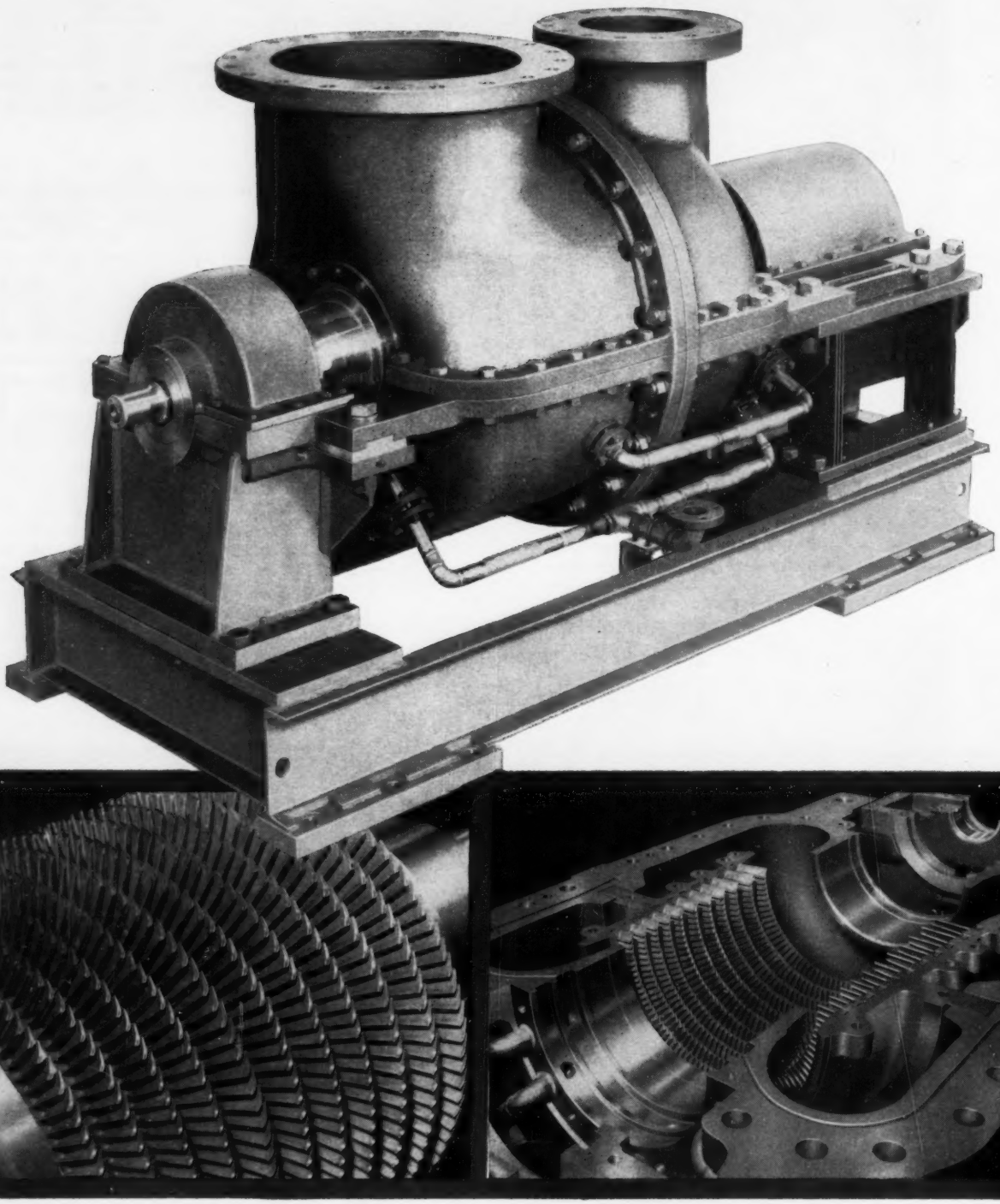
*Trade-mark

AMERICAN Cyanamid COMPANY

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

Additional information may be obtained regarding these products by writing on your business letterhead to the Division of American Cyanamid Company, 30 Rockefeller Plaza, New York 20, N. Y., indicated in the captions.

why let valuable hot gases go up the stack?



- Multi stages for minimum leaving losses.
- Twisted blades for maximum blade efficiency.
- Feather tip blades for close clearance — minimum inter stage losses.
- Bearings completely isolated from case.
- Stator blade carrier ring free to expand on guide pins in tongue and groove joint.

RECOVER WASTE ENERGY

here's how the new Clark Axial Flow Turbine puts waste hot gases to work

By expanding high temperature gases through the new Clark Axial Flow Turbines, up to 6500 hp can be recovered. Their conservative speeds permit direct connection, without gearing, to centrifugal compressors.

Built in two models, covering a 1500-6500 hp range, with inlet capacities of 3500-10,000 cfm, these highly efficient, specially designed, ultra simple Clark units can operate on gases with temperatures in excess of 1000 deg. F. They are ideally suited to use as recovery turbines in nitric acid plants, refrigeration cycles and, in fact, any place or process where there is a substantial volume of clean gases at moderate pressure and high temperature. Already, there are several in operation with more being built.

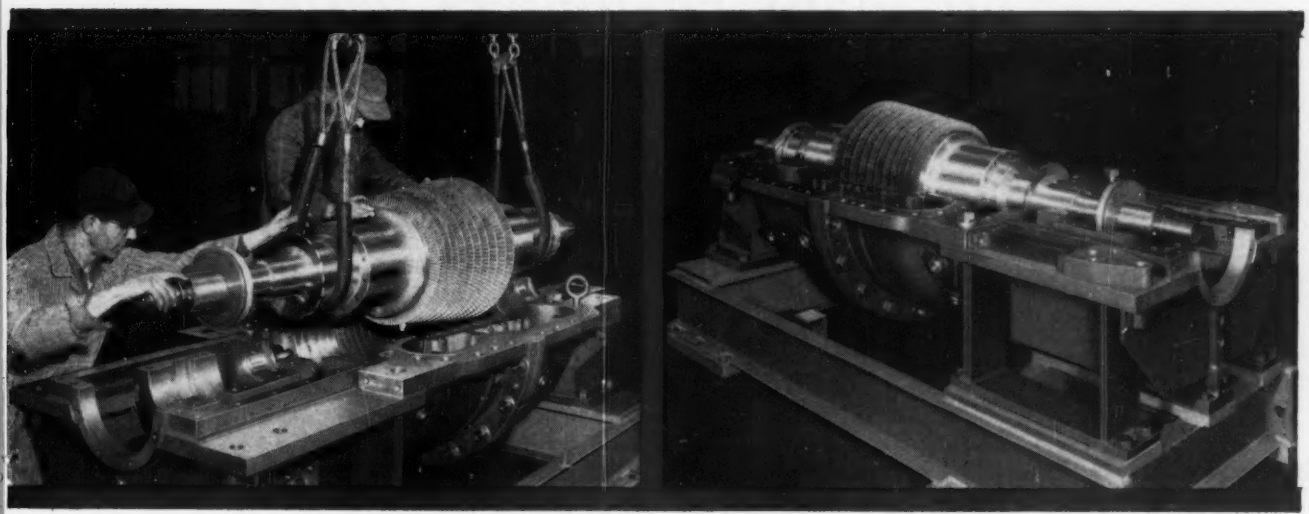
No longer need you confine your thinking to process temperatures under 1000 deg. F., because of a lack of suitable high temperature equipment. No longer need you throw away valuable heat energy. The new Clark Axial Flow Turbine may well solve your problems. Consult the nearest Clark office.

CLARK BROS. CO. • OLEAN, N. Y.

Offices in Principal Cities throughout the World

CLARK ONE OF THE DRESSER INDUSTRIES

TURBINES
ENGINES
COMPRESSORS



- Rotor dynamically balanced for vibration-free operation.
- Simple, accessible design for easy maintenance.
- Generous diameter, stiff shaft, rotor design.
- Unique Clark thermo-elastic support.
- Free radial and axial expansion without misalignment and distortion.
- Packaged. Mounted on a fabricated base and shipped as a complete drive assembly. Up or down connections.

Dependable Source for Chemical Raw Materials

Theron S. Dodson plans raw-material purchases to meet Barium Reduction's rising sales needs.

"Wyandotte's reliability helps us serve our many customers better"

— says Theron S. Dodson, purchasing agent, Barium Reduction Corporation, S. Charleston, W. Va.

"The barium chemicals we make are vital to many industries," states Theron S. Dodson, Barium Reduction Corporation. "For example, they are used in the manufacture of television tubes, electric light-bulb sockets, and molded rubber products — also in atomic research. All of these industries have their own peaks and valleys of production, and their demands on us vary.

"As a result, we have to have suppliers who can meet our ever-changing needs for raw materials — and meet them on time. Our suppliers must be able to meet our specifications, too. Anything less than the high-quality we require would only slow up our delivery, or cause trouble for our customers. I can assure you that we always receive excellent service and quality products from Wyandotte. When they say a car of soda ash or caustic soda is shipped, we can schedule our production on it."

Are you seeking a reliable source for chemical raw materials . . . a concern that believes in continuous programs of product development to serve many industries?

If you are, you'll find the people at Wyandotte good people to do business with. Experience with Wyandotte's products will prove their quality consistently uniform . . . and Wyandotte's service to your liking.

Why not talk over your requirements with a Wyandotte representative? You'll find a wealth of technical data available — as well as a willingness to work with you in applying our products to your needs. Or write us, giving as many details as possible about your problem. *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Offices in principal cities.*

Wyandotte CHEMICALS

Soda Ash • Caustic Soda • Bicarbonate of Soda • Chlorine
Muriatic Acid • Calcium Carbonate • Calcium Chloride
Glycols • Chlorinated Solvents • Synthetic Detergents
Other Organic and Inorganic Chemicals

MAINTENANCE? *what's that?*

With YARWAY Impulse Steam Traps, what little maintenance there is can be handled in a jiffy. There's only one moving part—a tiny valve.

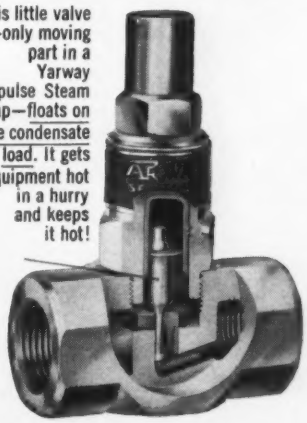
When the trap must be cleaned or repaired, it can be done right in the line—in a matter of minutes.

Other YARWAY features:

- **Stainless steel—body and internal parts.**
- **Gets equipment hot in a hurry—and keeps it hot.**
- **Good for all pressures without change of valve or seat.**
- **Easy installation—small size, light weight.**
- **Non-freezing at low temperatures.**
- **Six standard sizes, ½" to 2".**

Want proof of performance? Try a YARWAY Impulse Trap and Fine Screen Strainer FREE for 90 days in your own plant. For free trial or free catalog, write . . .

YARNALL-WARING COMPANY, 137 Mermaid Ave., Philadelphia 18, Pa.



This little valve —only moving part in a Yarway Impulse Steam Trap—floats on the condensate load. It gets equipment hot in a hurry and keeps it hot!

YARWAY **impulse steam trap**

OVER 1,000,000 YARWAY IMPULSE TRAPS SOLD—STOCKED BY 270 CONVENIENT INDUSTRIAL DISTRIBUTORS

FOR OVER 35 YEARS

KELLEY

SERVING THE PROCESSING INDUSTRIES

Engineers, designers, and fabricators of **STAINLESS STEEL**

CORROSION & HEAT RESISTANT EQUIPMENT

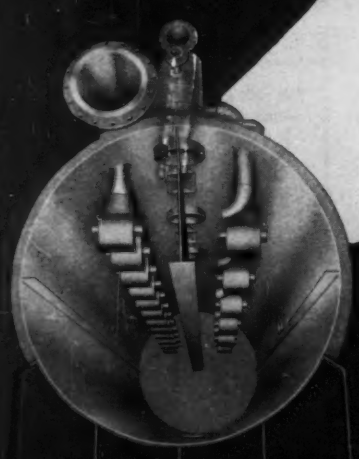
RADIATION SHIELDING

Installed anywhere in the world

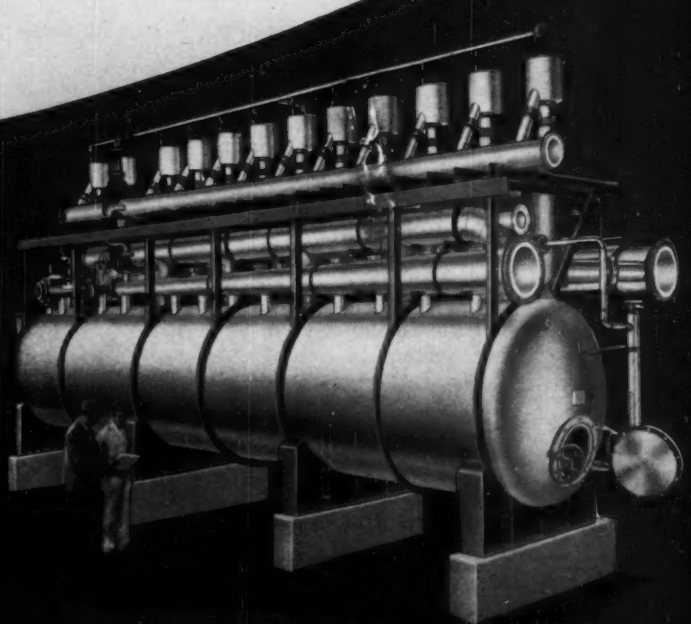
Custom built process equipment of special and intricate design is an everyday operation with the O. G. Kelley & Company.

With over three decades of "Experience" and "Know-How" O. G. Kelley & Company has gained the reputation of being "More Than Qualified" in the fabrication of equipment to meet the most exacting specifications.

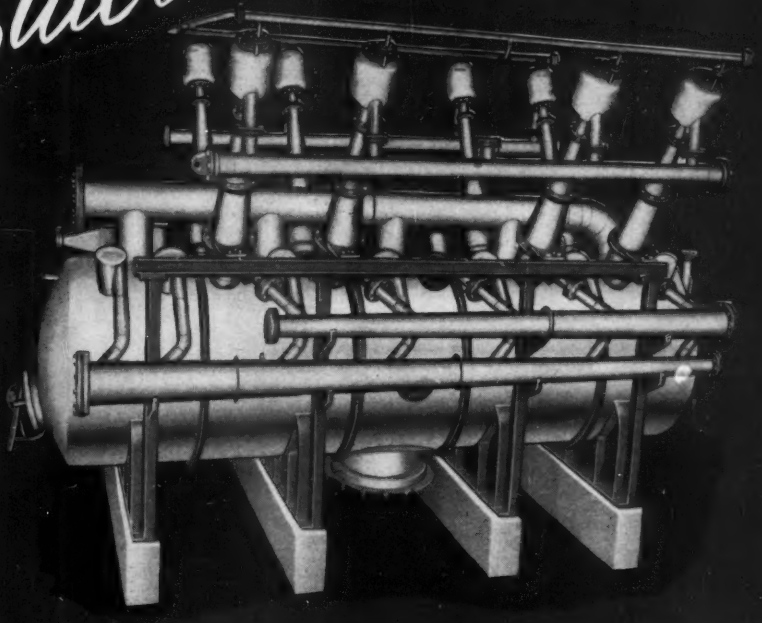
YOUR INQUIRIES ARE INVITED.



Interior View showing Internals of Specially Constructed Stainless Steel Unit at right



Custom Built



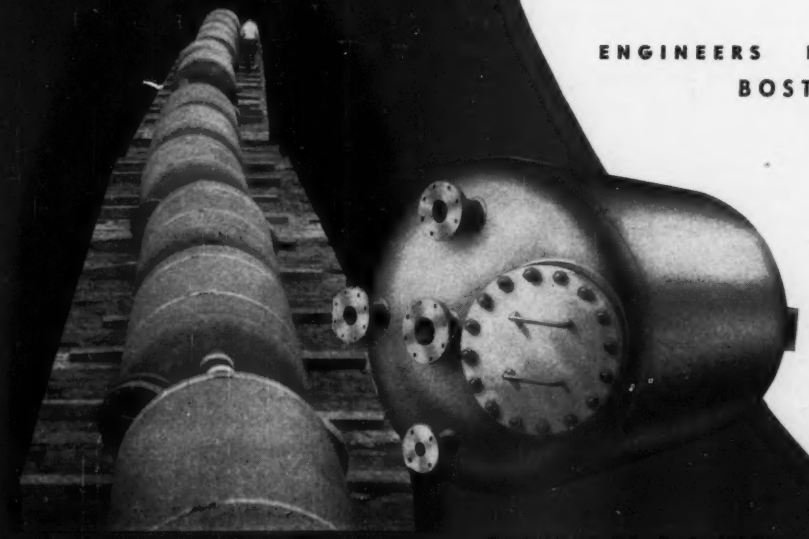
Stainless Steel Unit of Intricate Design and Precision Fabrication

O. G. KELLEY and Company

ENGINEERS DESIGNERS FABRICATORS

BOSTON 22, MASSACHUSETTS

JOHNSON CITY, TENN.
CLEVELAND, OHIO
ELIZABETH, N. J.
NEW YORK, N. Y.
PITTSBURGH, PA.
HOUSTON, TEXAS



You get

SERVICE WITH A SMILE...

when you specify **AIRTEMP** for business and industrial air conditioning

So many people are eager to help you when you specify Airtemp!

First there are the *top engineers* of Airtemp Construction Corporation . . . ready to give you the benefit of years of *specialized* experience in air conditioning.

Then there are your *local* Airtemp service men—factory-trained and equipped to guarantee on-the-spot service through the years ahead.

All the people you deal with are fully trained by Airtemp and *Chrysler*—names long famous for advanced engineering and quality manufacture.

The result of Airtemp's fine engineering and efficient design is extremely low operating cost. So, when you consider that there's an Airtemp system to meet *every* qualification—there's hardly any reason for *not* specifying Airtemp!

AIRTEMP SERVES THE NATION!

CHRYSLER BUILDING EAST, New York, N. Y. Architects: Reinhard Hofmeister & Walquist; Consulting Engineers (Structural) Edwards & Hjorth; Consulting Engineers (Mechanical & Electrical): Guy B. Panero.

HAROLD GRUBMAN CO., North Hollywood Calif. Engineer: Sam L. Kaye, Los Angeles; Builders: Craig and Randall, Los Angeles.

"AIRTEMP *BUILDS* AIR CONDITIONING TO FIT ANY REQUIREMENT!"

Write for information. *For complete details on what Airtemp offers you, write to: Airtemp Construction Corporation, Dayton 1, Ohio*

Airtemp
DIVISION
CHRYSLER CORP

AIR CONDITIONING · HEATING FOR HOMES, BUSINESS, INDUSTRY

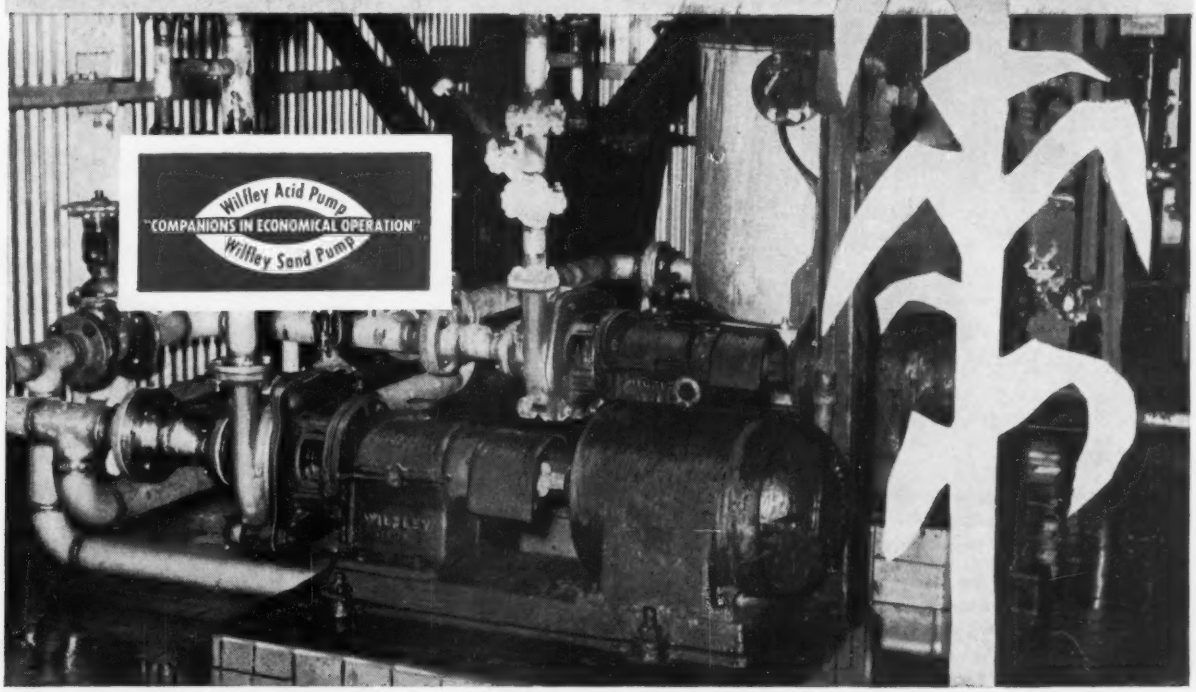
WILFLEY

helps the corn grow tall!

Fertilizer is one of the many end-products that originate in modern chemical plants. In many of these plants **WILFLEY ACID PUMPS** are a vital factor in the production of ammonium nitrate—a basic ingredient. Wherever installed, highly efficient Wilfley pumps reduce pumping costs and increase production . . . operate without attention, delivering trouble-free performance on round-the-clock schedules. Available with pumping parts of the machinable alloys as well as plastic to meet all requirements. Individual engineering on every application. Write or wire for complete details.

A. R. WILFLEY and SONS INC. Denver, Colorado, U.S.A.
New York Office: 1775 Broadway, New York City

Photo shows Wilfley Acid Pumps handling **AMMONIUM NITRATE at HIGH HEADS**



For wider adaptation . . . and unmatched Service Life . . . . .

Vogt GENERAL GP PURPOSE* DROP FORGED VALVES

We invite you to inquire into the savings which the new line of Vogt GP Drop Forged Steel Valves can make possible in your operations. Not only do their many unique and exclusive features make them more economical of operation, but their broad adaptability to so many industrial applications permits a substantial reduction in operating overhead. Service life, too, is enhanced with Stellite faced seating surfaces which are available at no extra cost along with many other trims.

FREE
Supplement No. 1 to Vogt Catalog F-9

* GP Valves completely fill the demands of industry for a line of compact, lighter weight, shorter face-to-face valves.

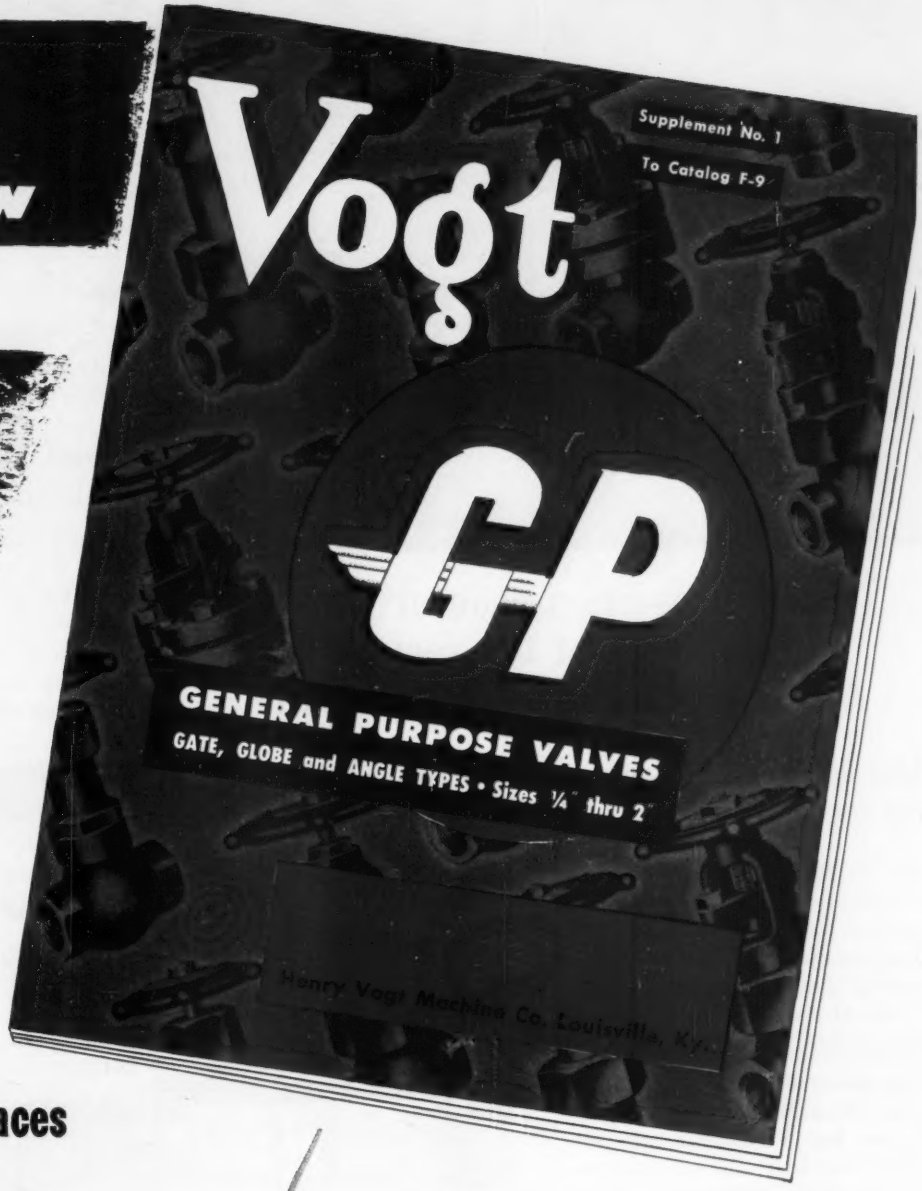
Still retaining the safety and ruggedness inherent in a wrought material, these new forged steel screw and socket weld end valves, in sizes from ¼" through 2", are rated 800 pounds at 850°F. and 2,000 pounds at 100°F.

SPACE 56
CHEMICAL SHOW

the New

STEEL

E S



150-800 Pounds Service
(2000 pounds cold)

•

Featuring Stellite Faced Seating Surfaces

•

Sizes ¼" to 2"

This 32-page catalog illustrates and gives complete specifications on 11 types of the new Vogt GP forged steel gate, globe and angle valves. Send for your free copy — for ready reference in purchasing. Use the coupon for convenience.

HENRY VOGT MACHINE CO.
LOUISVILLE 10, KENTUCKY

SALES OFFICES: New York, Philadelphia, Cleveland, Chicago, St. Louis, Charleston, W. Va., Cincinnati, Dallas, San Francisco

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Gentlemen:

Please send copy of New Vogt Catalog Supplement No. 1 to . . .

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for your information...

brief summaries of helpful product news

Giant glass-lined reactor proves advantages of fire-resistant Aroclor 1248 heat-transfer fluid

Monsanto heat-transfer medium specified

The Argus Chemical Company, Brooklyn, N. Y., has installed a giant reactor to produce heat and light stabilizers for vinyl chloride plastic. The system utilizes Aroclor* 1248, Monsanto's fire-resistant, liquid-phase, heat-transfer fluid.

The 3500-gallon, glass-lined kettle —largest of its kind in the United States—has an automatic, pressureless system which operates at temperatures up to 550° F.

With Aroclor 1248 used for both heating and cooling operations, there is maximum protection against the type of fire hazard inherent in other systems. Aroclor 1248 is designed for operation at atmospheric pressure; it has a boiling point sufficiently above 600° F. to maintain a liquid condition at all times. The material possesses viscosities which permit pumping at room temperatures.

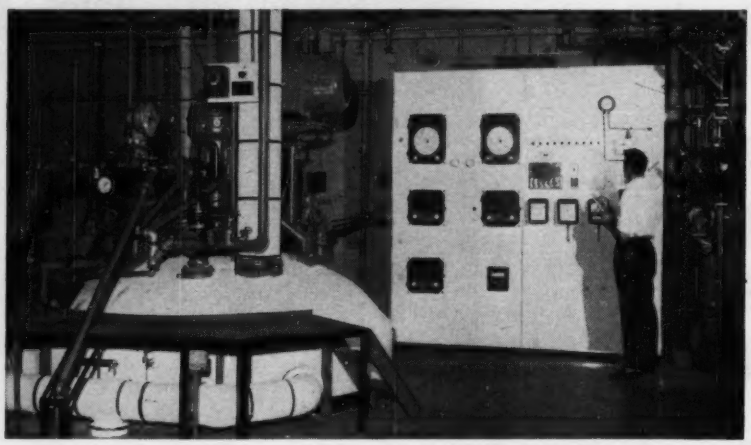
Aroclor 1248 offers important advantages

As a fire-resistant, heat-transfer medium, Aroclor 1248, a chlorinated biphenyl, offers chemical processors these critical benefits:

- Stability against heat.
- An adequate safety margin to accommodate accidental overheating.
- Reduced corrosive action.
- Controlled vaporization loss.
- Freedom from toxicity hazard in properly enclosed systems.

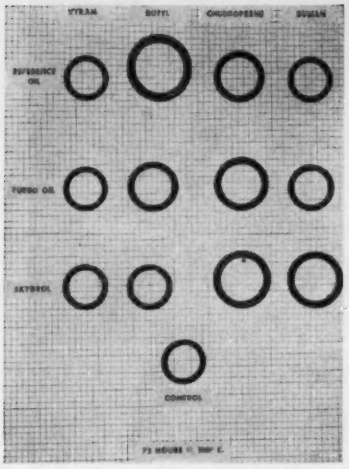
Send for informative bulletin today

For more information about Aroclor 1248 as a heat-transfer fluid, write for Monsanto's Technical Bulletin No. O-P-130. This bulletin describes the physical properties of Aroclor 1248 and illustrates the design and operation of typical heaters.



Upper level of reactor with panel board for thermal system in background.

Specially designed glass-lined kettle has 3500 gallon capacity.



Vyram O-rings (vertical column, far left) show no signs of swell or distortion even after prolonged immersion tests.

New elastomer highly resistant to hydraulic fluids and many solvents

Monsanto's Vyram* is a remarkable synthetic elastomer which resists the swelling action of both synthetic and petroleum-base hydraulic fluids and lubricants.

Proved by extensive tests, Vyram has demonstrated its ability to withstand the chemical action of a variety of solvents and other fluids.

Comprehensive immersion data on Vyram in alcohols, aldehydes, amines, esters, ether, glycols, hydrocarbons, ketones, oils, substituted hydrocarbons and functional fluids are presented in a new technical bulletin just issued on Vyram.

Also included in the bulletin are physical properties, compounding data, processing information and a summary of properties imparted by various curative systems.

If you manufacture elastomeric seals, Vyram may be just the material you've been looking for. For technical information, check the coupon and mail today.

New bulletin on insect killer Methyl Parathion available

One of the industry's most effective insecticides, Monsanto's Methyl Parathion, offers formulators an important addition to their line.

Described in detail in a bulletin just issued are these facts about Methyl Parathion: product characteristics and features, registrations for use (at USDA and state levels), precautions for handling, and important formulation information.

Order your copy today.

Latest information on bulk tank storage of plasticizers ready

Production people handling plasticizers will find important information in Monsanto's newly revised, 16-page bulletin, "The Bulk Tank Storage of Plasticizers."

Topics covered in this illustrated bulletin: materials of construction particularly useful in setting up bulk tank storage units, storage tanks, pipe lines, pumps and filters, tank car and truck unloading, safety precautions, etc.

Write Monsanto for your copy.

More coatings and adhesives uses forecast for Santolite MHP

Santolite MHP gives specialized properties to adhesives and coating formulators using cellulosics, polyamides and most vinyl resins.

A water-white sulfonamide-formaldehyde condensation resin, Santolite MHP is widely used to give polyvinyl acetate adhesives quick tack. Usually compounded with a liquid plasticizer like Santicizer 160, dibutyl phthalate or with a mixture of these plasticizers and triphenyl phosphate, it forms a tough but flexible adhesive for bonding cellophane to cellophane, aluminum foil to paper.

In coatings such as nitrocellulose lacquers, Santolite MHP is used extensively for a greater degree of clarity, gloss, heat sealability, oil- and moisture-resistance.

Because of its wide range of compatibility and its strong solvent power, Santolite MHP is a standard component for use with cellulose acetate to increase that resin's retentivity for other plasticizers and resins.

Let us send you more information about Santolite MHP and its companion resin, Santolite MS-80%. Just check coupon.

*Reg. U. S. Pat. Off.

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CHEMICALS - PLASTICS

WHERE CREATIVE CHEMISTRY WORKS WONDERS FOR YOU

MONSANTO CHEMICAL COMPANY
808 North 12th Street, St. Louis 1, Mo.

11/55

Please send me the items checked below:

- ☐ Aroclor 1248 Heat Transfer Fluid, Tech. Bul. No. O-P-130.
- ☐ Vyram Synthetic Elastomer, Tech. Bul. No. ODB-55-21
- ☐ Methyl Parathion, Tech. Bul. No. O-55
- ☐ The Bulk Tank Storage of Plasticizers Tech. Bul. No. O-69
- ☐ Santolite MHP and MS-80%, Tech. Bul. No. O-94

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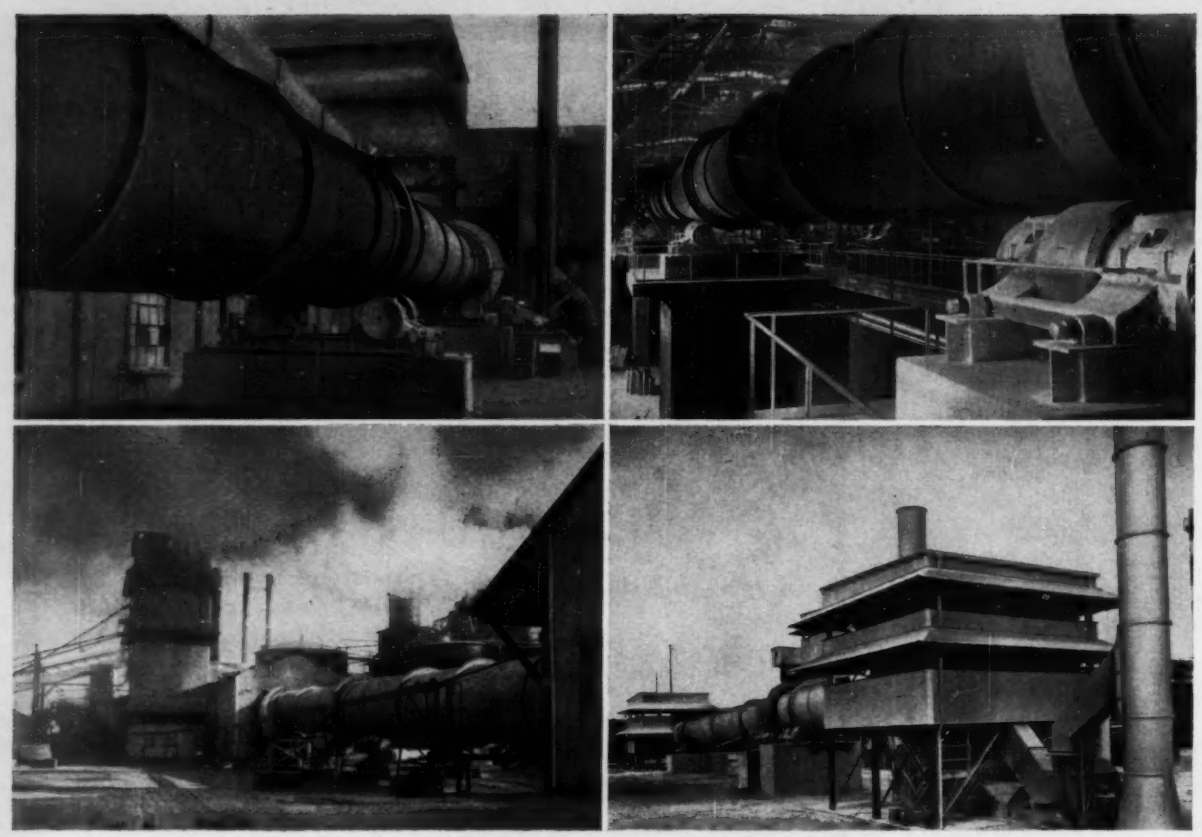
City..... Zone..... State.....



Traylor Rotary Kilns Save Thermo-Processing Dollars because they're built with the biggest background of engineering experience in the field

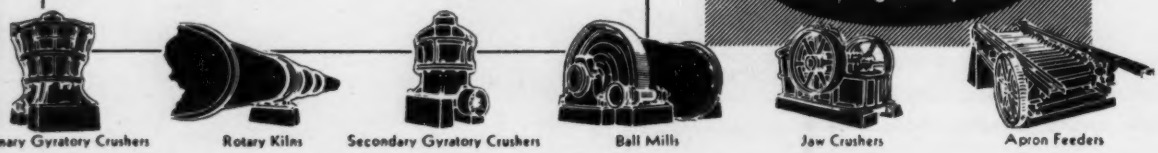
For over 40 years Traylor has been building Rotary Kilns for calcining, roasting and chloridizing, volatilizing, sintering and nodulizing. In the past 14 years alone, more than 150 Traylor Rotary Kilns have been built for processing some 21 different materials . . . an average of almost 1 kiln a month. With more than 33,000 feet of rotary kiln construction in this period, Traylor has the backlog of experience necessary to design a kiln for any thermo-processing operation.

In addition to the many recognized operating and maintenance economies offered by Traylor Rotary Kilns, many new thermo-processing problems have been solved through Traylor's accumulated knowledge of kiln construction.

"Traylor-Made" to fit each individual job, Traylor Rotary Kilns have been made in 12′ diameter, 450′ long. Bulletin #1115 gives complete description, illustrations and specifications. Send for your free copy today.

TRAYLOR ENGINEERING & MFG., CO.
1701 MILL ST., ALLENTOWN, PA.
SALES OFFICES: New York • Chicago • San Francisco
Canadian Mfrs: Canadian Vickers, Ltd., Montreal, P.Q.

A Traylor leads to greater profits

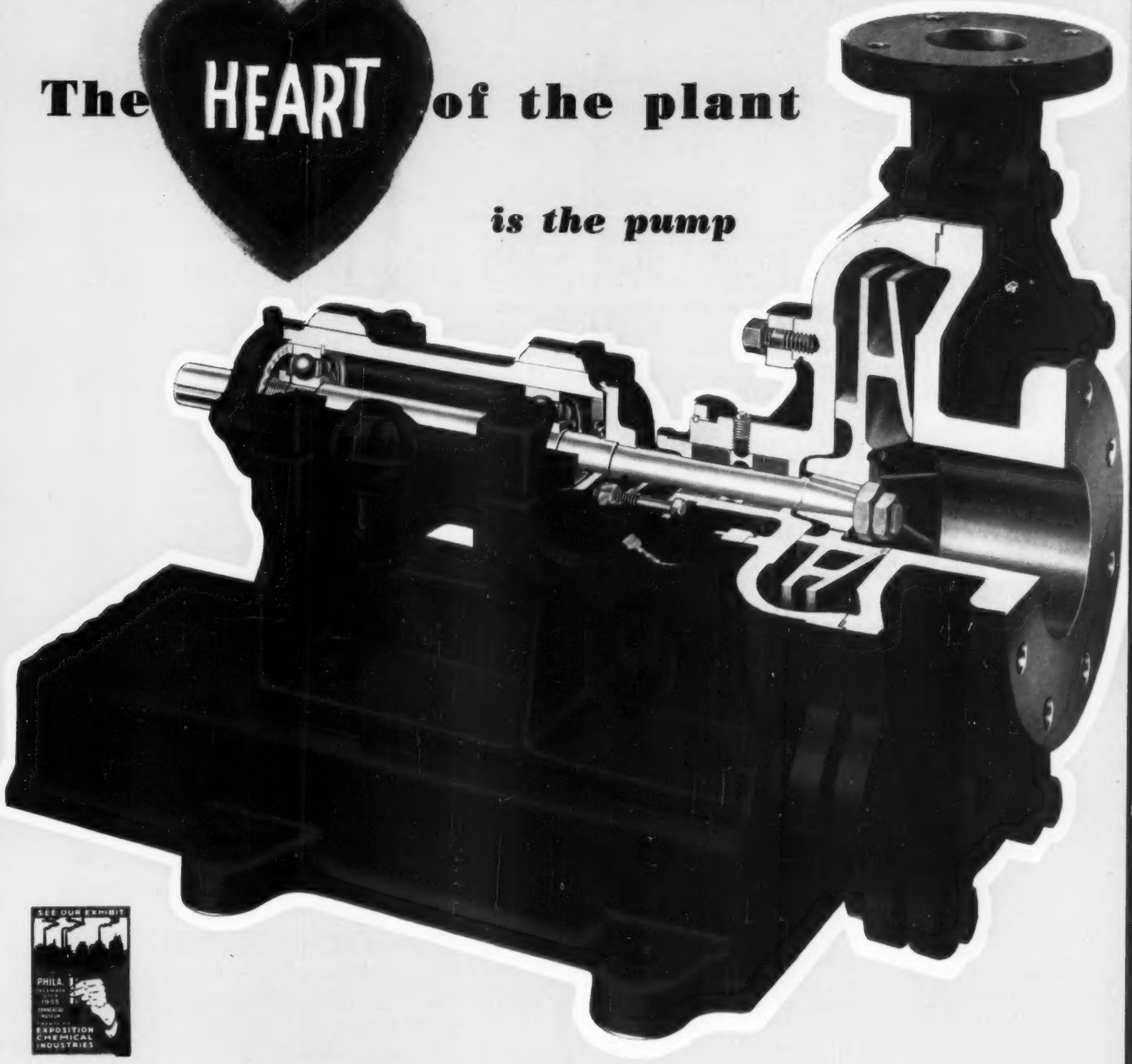


Primary Gyratory Crushers | Rotary Kilns | Secondary Gyratory Crushers | Ball Mills | Jaw Crushers | Apron Feeders

It's well to remember

The HEART of the plant

is the pump



...the MISSION *Centrifugal Pump*

When you have a Mission Centrifugal pump as the heart of your plant you are assured of a smooth, continuous flow that eliminates vibration and minimizes turbulence. Standard concentric casings range from 1″ to 6″ discharge sizes. Mission Centrifugal Pumps are available in capacities up to 2,000 GPM, heads up to 500 feet.

All parts coming in contact with fluids pumped are available in cast iron, carbon steel, bronzes, aluminum, stainless steel, Ni-Resist, Monel, nickel, Misaloy 3, 10, or 20, and any other metal which can be cast and machined.

MISSION MANUFACTURING CO.

CENTRIFUGAL PUMP DIVISION

P. O. BOX 4209 • HOUSTON, TEXAS

VISIT WITH US IN BOOTH 213

- ☐ Alum
- ☐ Aluminum Oxide
- ☐ Ammonium Sulphate
- ☐ Arsenic Oxide
- ☐ Asbestos Dust
- ☐ Asphalt Fillers
- ☐ Barite
- ☐ Bauxite
- ☐ Bentonite
- ☐ Bone, steamed
- ☐ Borax
- ☐ Calcium Carbonate
- ☐ Calcium Phosphates
- ☐ Carbon, activated
- ☐ Carbon Black
- ☐ Catalysts, Petroleum
- ☐ Cellulose Acetate
- ☐ Cement, Portland
- ☐ Cement Raw Material
- ☐ Chalk
- ☐ Chromite
- ☐ Clays
- ☐ Coal, pulverized
- ☐ Coke Dust
- ☐ Copper Converter Dust
- ☐ Corn Flakes (brewers')
- ☐ Corn Grits
- ☐ Cottonseed Meal
- ☐ Cryolite
- ☐ Cyanamid
- ☐ Detergent Powders
- ☐ Dextrin
- ☐ Diatomaceous Earth
- ☐ Dicyandiamide
- ☐ Dolomite
- ☐ Feed Ingredients
- ☐ Feeds, soft
- ☐ Feldspar
- ☐ Ferrochrome
- ☐ Fertilizers
- ☐ Flaxseed
- ☐ Flint
- ☐ Flue Dusts
- ☐ Fluorspar
- ☐ Fly Ash
- ☐ Fuller's Earth
- ☐ Gilsonite
- ☐ Graphite
- ☐ Gypsum (raw or calcined)
- ☐ Ilmenite
- ☐ Iron Salts
- ☐ Lime, hydrated
- ☐ Lime, pebble
- ☐ Lime, pulverized
- ☐ Limestone, pulverized
- ☐ Litharge
- ☐ Magnesite
- ☐ Magnesium Oxide
- ☐ Malt
- ☐ Manganese Dioxide
- ☐ Milk, dried
- ☐ Mineral Wool
- ☐ Nylon pellets
- ☐ Ores, pulverized
- ☐ Petroleum Coke (fluid process)
- ☐ Phosphate Rock, pulverized
- ☐ Polyethylene
- ☐ Pyrites
- ☐ Quartz, pulverized
- ☐ Resins, synthetic
- ☐ Rubber pellets
- ☐ Salt
- ☐ Salt Cake
- ☐ Silica, pulverized
- ☐ Slag, pulverized
- ☐ Slate, pulverized
- ☐ Soap Powders
- ☐ Soda Ash
- ☐ Sodium Bicarbonate
- ☐ Sodium Phosphates
- ☐ Starches
- ☐ Sugars, refined
- ☐ Talc
- ☐ Titanium Dioxide
- ☐ Wood Chips
- ☐ Wood Flour
- ☐ Zinc Oxide

NOW YOU CAN BUY AND CONVEY IN BULK

New profit opportunities await every company prepared to modernize its operations by buying materials in bulk and conveying them in sanitary, completely enclosed systems from railroad car or truck to storage, thence to process and shipping.

When you visit the Chemical Show, make it a point to drop by Booth 213 for a chat with experienced Fuller representatives about Fuller conveying systems, the way they are being profitably used to handle dry bulk materials, and how Fuller-engineered systems can help you make more money.

Fuller

. . . pioneers in harnessing AIR

FULLER COMPANY GENERAL AMERICAN TRADE MARK

FULLER COMPANY, Catasauqua, Pa.

A SUBSIDIARY OF GENERAL AMERICAN TRANSPORTATION CORP.

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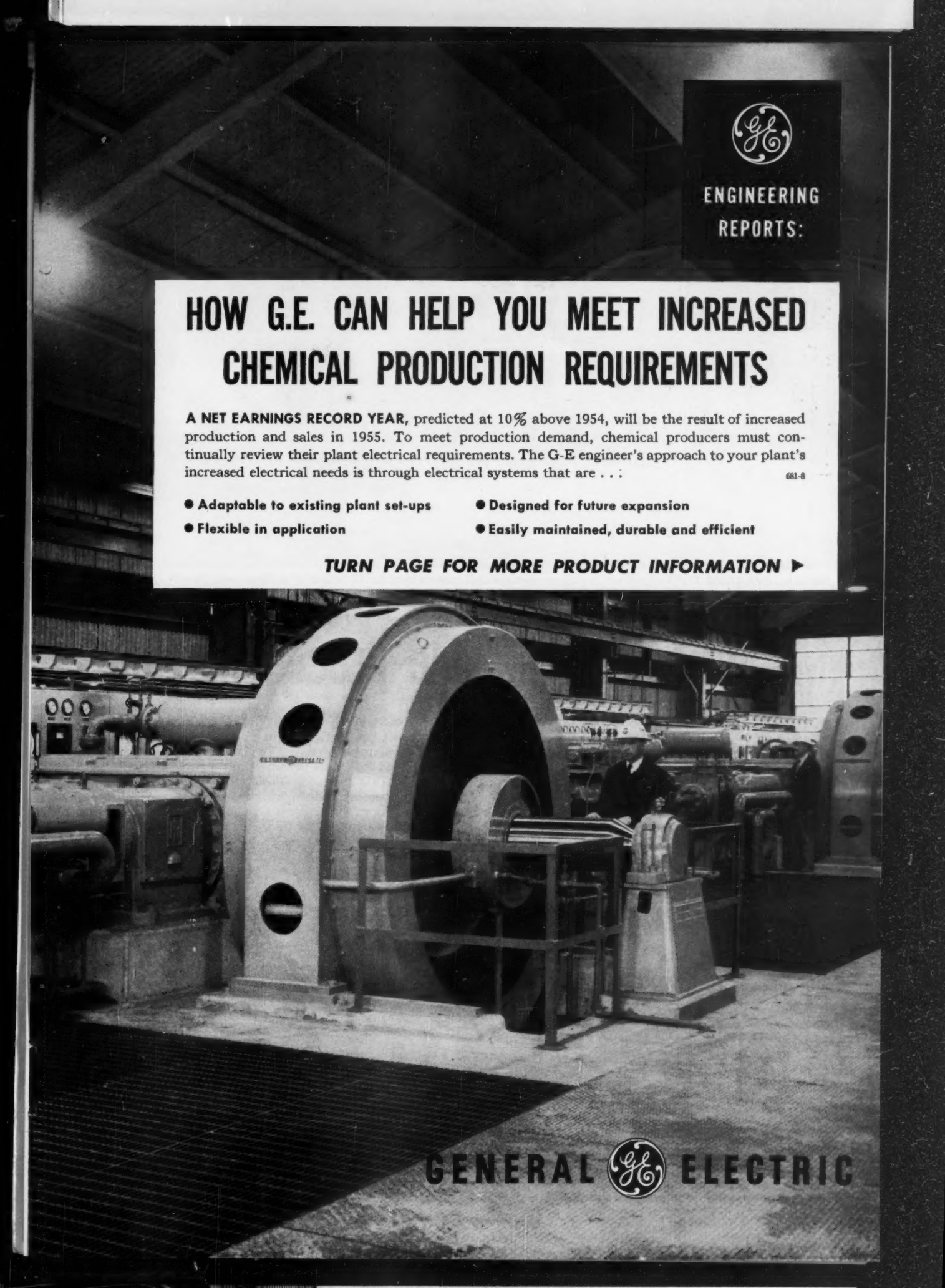
G-124
1963


ENGINEERING
REPORTS:
HOW G.E. CAN HELP YOU MEET INCREASED CHEMICAL PRODUCTION REQUIREMENTS
A NET EARNINGS RECORD YEAR, predicted at 10% above 1954, will be the result of increased production and sales in 1955. To meet production demand, chemical producers must continually review their plant electrical requirements. The G-E engineer's approach to your plant's increased electrical needs is through electrical systems that are . . . 681-8
● Adaptable to existing plant set-ups
● Designed for future expansion
● Flexible in application
● Easily maintained, durable and efficient
TURN PAGE FOR MORE PRODUCT INFORMATION ▶
GENERAL ELECTRIC

SEVERAL AVAILABLE TYPES of protective enclosures make G-E motors ideal for all indoor or outdoor uses. New Polyex insulation

G-E ENGINEERED DRIVES AND POWER SYSTEMS MEAN . . .

Modern, more flexible processing lines

IN THE NEXT TEN YEARS, production must increase an estimated 50% to meet greater consumer needs. Available manpower will increase only an estimated 14% during the same period.

INCREASED OUTPUT AND EFFICIENCY must close the production gap between available manpower and estimated demand. General Electric electrical systems are designed and installed for efficient, flexible, easily expanded production.

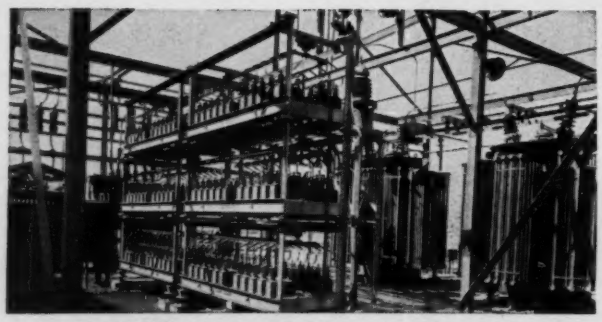
G-E ENGINEERING SERVICES (see back page) can help you meet production requirements to bring your electrical system up to date. The result is a modern system integrated into your present plant setup.

FOR ADDITIONAL INFORMATION on how G-E engineered systems and engineering services can help you, contact your G-E Apparatus Sales Representative during your early planning at the nearest G-E Apparatus Sales Office. General Electric Company, Schenectady 5, N. Y.

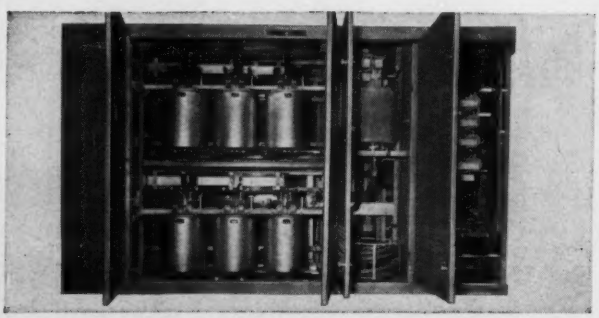
681-5

Engineered Electrical Systems for Process Industries

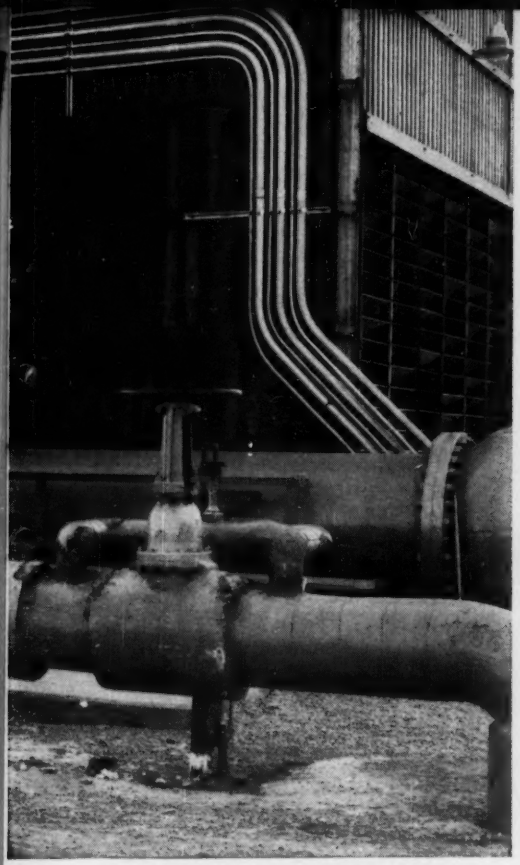
GENERAL ELECTRIC



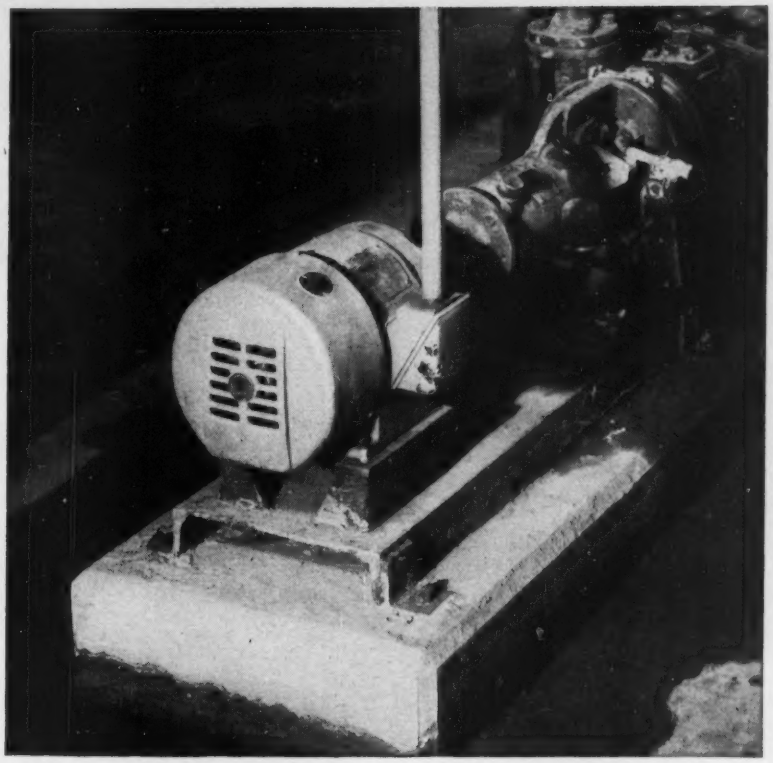
"BUILDING-BLOCK" design of this stack-rack capacitor block reduces installation costs. This design means equipment may easily be expanded or moved to meet plant requirements.



HIGH EFFICIENCY and low installation cost of this pumpless rectifier provide more reliable and economical d-c power. Factory wired, the unit is ready when it arrives to connect and operate.



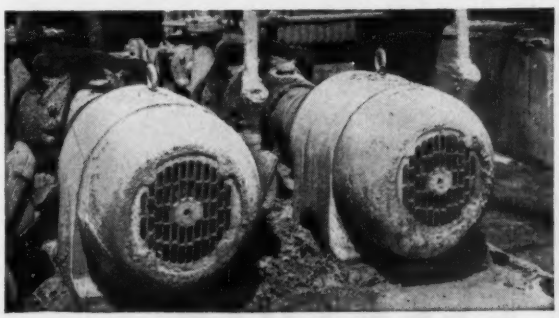
gives up to 50% longer motor life.



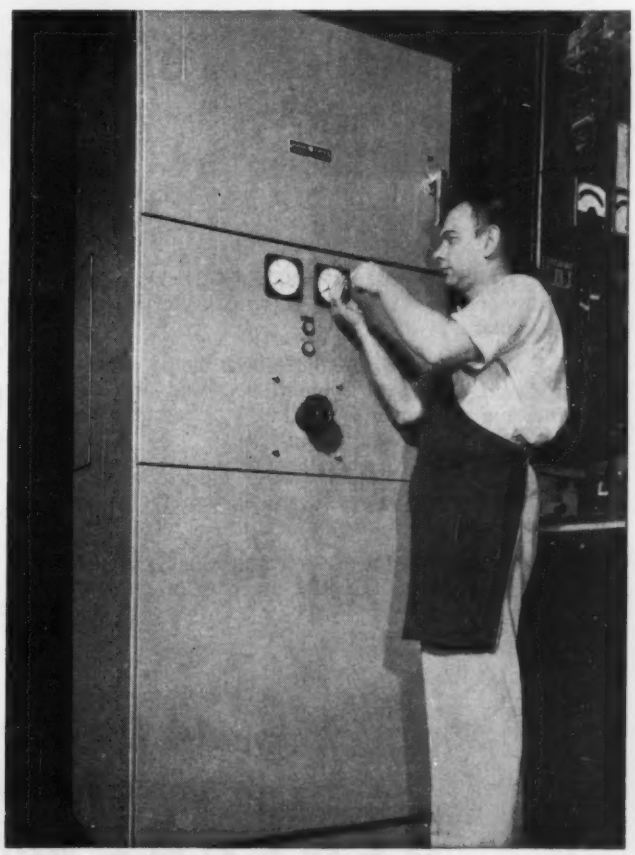
NEW G-E TRI-CLAD* '55' MOTORS, totally enclosed, are suitable for damp areas, even where hosing is necessary. New cooling system cleans while it cools motor.

for your plant

G-E MAGNETIC STARTERS and safety switches are compact, for maximum space savings. Short-circuit protection is provided by circuit breaker or fusible disconnect switch.

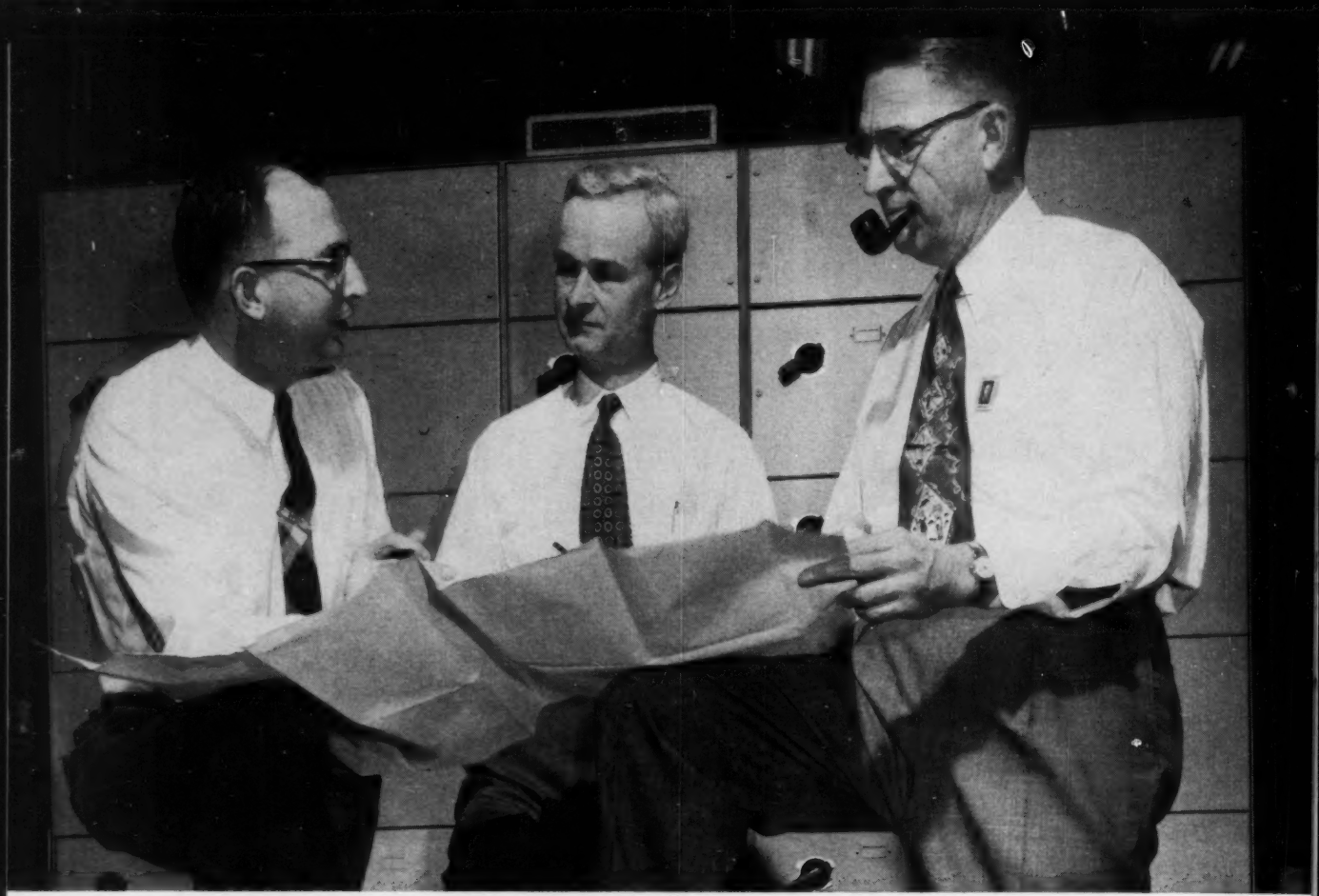


CORROSIVE ATMOSPHERE effects are greatly minimized in these G-E Tri-Clad induction motors. Rugged cast-iron construction makes them excellent for process application.



SHORT CIRCUIT PROTECTION up to 60,000 amps, plus 50% greater space savings are provided by all-new G-E Limitamp*.

*Reg. Trademark of General Electric Company



SIX G-E ENGINEERING SERVICES . . .

HELP YOU PROTECT YOUR EQUIPMENT INVESTMENT

1 **G-E APPLICATION ENGINEERING** helps you and your consultants design the right electric system for your plant.

2 **G-E ANALYTICAL ENGINEERING** helps attain the optimum electrical system for your application. Engineering experience backed up by electronic system analyzers save valuable design time.

3 **G-E PRODUCT DEVELOPMENT** laboratories design and test new equipment under tomorrow's conditions to meet your future demands.

4 **G-E FIELD-SERVICE ENGINEERING** helps you supervise installation, expedite start-up of your major electric equipment.

5 **G-E MAINTENANCE SERVICE** from 36 G-E Service Shops will repair and uprate your old equipment, help establish productive maintenance of your equipment, furnish emergency service.

6 **G-E PROJECT CO-ORDINATION** means on-time engineering, shipment, installation of your electric equipment from preliminary diagrams through start-up.

These valuable services are available to you with General Electric equipment. Contact any General Electric Apparatus Sales Office. Meanwhile, for the full story of G-E engineering services, write for brochure GED-2244, General Electric Co., Section 681-5, Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

This Photo is One-Third Actual Size...

OF A COMPLETE VEELOS V-BELT INVENTORY IN THE O, A, B AND C WIDTHS!

Put an end to endless space and inventory problems. Four reels of Veelos adjustable v-belt replace up to 316 different sizes of endless belts... and take up a space of only 16 inches square.

VEELOS
THE BALANCED
LINK V-BELT

Over 350 distributors throughout the country. Veelos is known as Veelink outside the United States.

ADJUSTABLE TO ANY LENGTH • ADAPTABLE TO ANY DRIVE

WRITE FOR A FREE COPY... of the Veelos Data Book. It's packed with valuable engineering data complete with illustrations. Send for your copy today.

MANHEIM MANUFACTURING & BELTING CO.
602 Manbel St., Manheim, Pa.

Pumping Progress Report

FOR HYDRAULIC ENGINEERS

An advertisement prepared by the Aldrich Pump Co., Member of Hydraulic Institute, U.S.A.

PUMP INSPECTION, MAINTENANCE AND REPAIR are jobs too frequently ignored in the design of production pumps. This has been verified by a survey of more than 15,000 pump installations. Speed and economy of maintenance was frequently quoted as a major factor in pump selection.

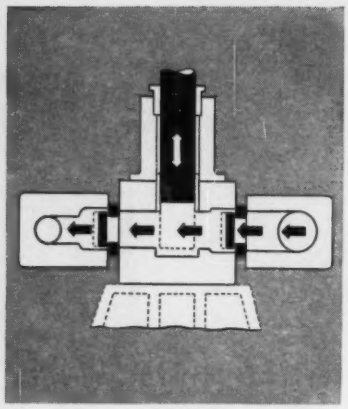
SECTIONALIZED FLUID-ENDS offer one of the best ways to guarantee both speed and economy in pump maintenance. As originated by ALDRICH Pump Co. Engineers, the Sectionalized Fluid-End comprises four main assemblies — the working barrel, suction manifold, discharge manifold and stuffing box.

SPEED IN MAINTENANCE is assured because of ease of accessibility of all wearing parts. Manifolds can be slid back on studs and valves removed as complete units. Split collar and flange connection of plunger to yoke permits easy removal of plunger.

ECONOMY OF MAINTENANCE results from speed in maintenance. Perhaps even more important is the simple fact that it is cheaper to replace a single section than a complete fluid-end. Another important economy is parts interchangeability. Among 3-, 5-, 7- and 9-plunger units of any series, wearing parts are interchangeable. Where a combination of multiplex pumps is required, this reduces spare parts stocks.

THE ALDRICH PUMP COMPANY is the originator of the DIRECT FLOW principle — a design innovation that utilizes the sectionalized fluid-end principle. Aldrich Engineers have become known as the people to take your tough pumping problems to. We have never turned down a challenge.

FURTHER INFORMATION can be had direct from the company. Tell us your problem and we'll send you Data Sheets describing the size pump we recommend to solve your problem. Address your request to: The Aldrich Pump Company, 3 Gordon Street, Allentown, Pa.



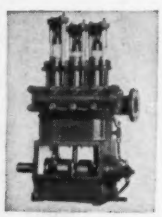
Aldrich Direct Flow Fluid-End Design

...for your tough pumping problems specify ALDRICH

The Direct Flow principle, an Aldrich design innovation, is a major forward step toward the solution of tough pumping problems of all kinds. Not only does it eliminate two right-angle turns in the fluid-end, but in addition makes possible complete Fluid-End Sectionalization. This is another Aldrich design innovation which permits economies of maintenance and repair offered by no other type pump.

CHECK THESE ADVANTAGES OF SECTIONALIZED FLUID-ENDS:

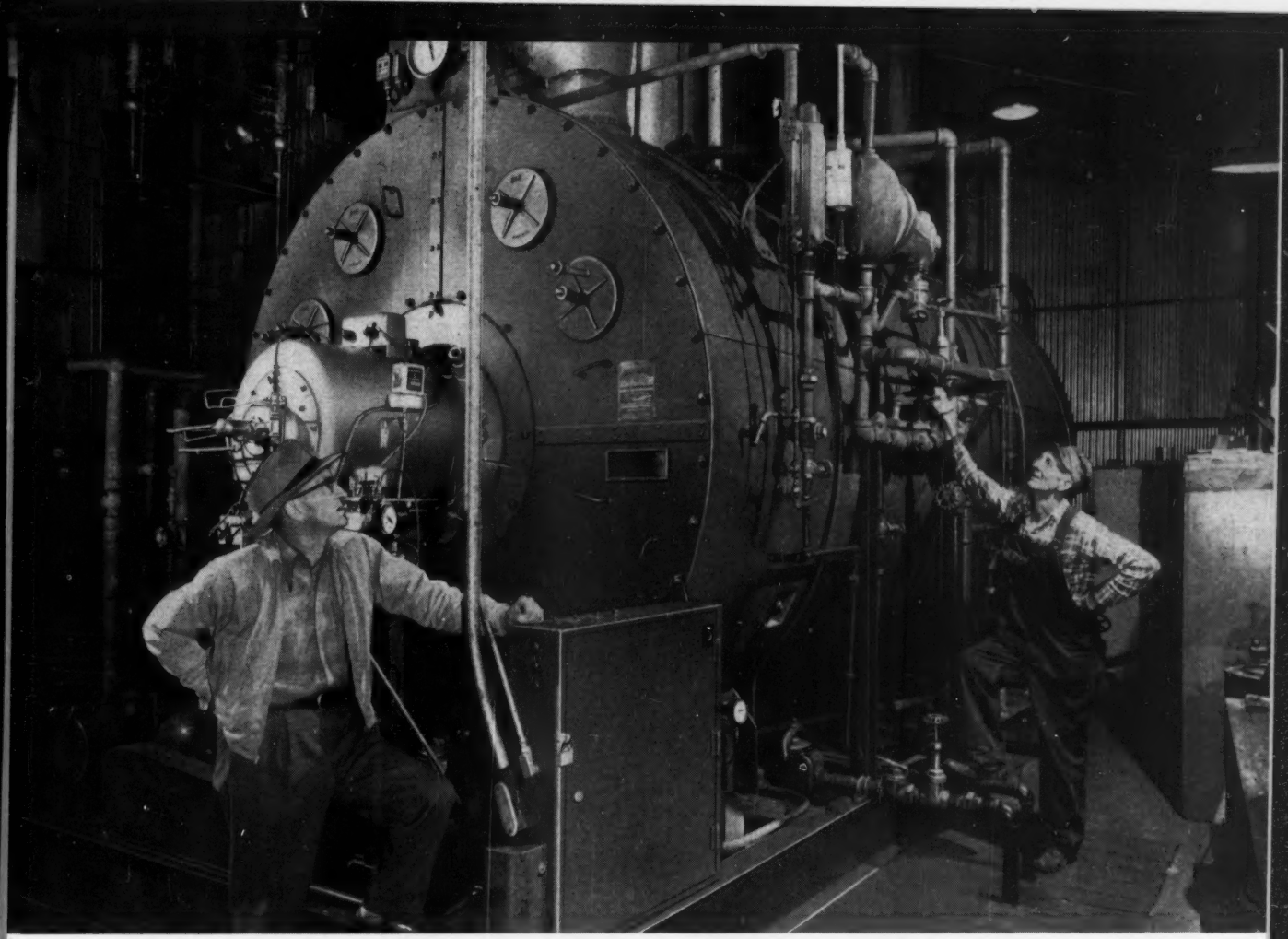
Less expensive parts replacement
Ease of inspection and maintenance
Interchangeable wearing parts
No special equipment for valve removal
Easily accessible stuffing boxes



Write today for Data Sheets describing the Direct Flow Pump Series.

THE ALDRICH PUMP COMPANY

Originators of the Direct Flow Pump
3 GORDON STREET
ALLENTOWN, PA.
Representatives in principal cities



Why does ONE *Powermaster*® sell OTHERS in nearby plants?

You get MORE than Operating Efficiency with Powermaster

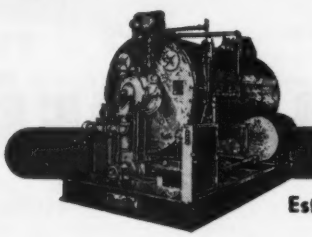
- ★ Low-cost, space-saving installation
- ★ Fast steaming
- ★ Instant response to load changes
- ★ Quick fuel change-overs
- ★ Clean, dry steam
- ★ Automatic operating and safety controls
- ★ High fuel economy at all loads
- ★ Clean, quiet operation
- ★ Smokeless combustion
- ★ One-source responsibility for complete unit
- ★ Nation-wide factory-trained service organization
- ★ Pay-As-You-SAVE Purchase Plan

This 500 HP *Powermaster* Packaged Automatic Boiler installed in a West Coast food processing plant has led to the purchase of four *Powermaster* units by other companies in the same area.

The reason for these extra sales is because *Powermaster* is solving two steam problems—more steam for processing, and more efficient off-season heating by means of modulating control of firing rate.

You can now purchase a completely factory-assembled and fire-tested *Powermaster* on the new Pay-As-You-SAVE Purchase Plan that helps you pay for your new boiler out of the savings it brings you.

Write for Bulletin 1220 or ask our representative to tell you how *Powermaster* can meet your requirements.



Powermaster®

PACKAGED AUTOMATIC BOILERS

In sizes to 500 HP; pressures to 250 psi.

ORR & SEMBOWER, INC.

Established 1885 • Morgantown Road, Reading, Pa.

Get Both
bearing features

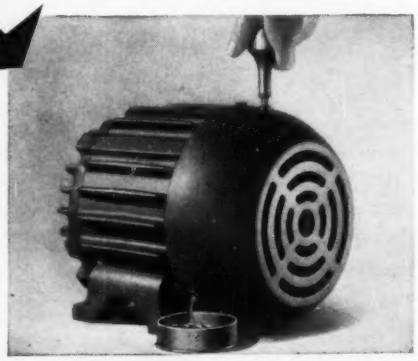
fully enclosed and protected

The bearing is enclosed with a bearing cap held tightly in place against the inner face of the bearing enclosure. This cap, with its close running clearances, keeps grease from the interior of the motor . . . retains an ample supply within the bearing enclosure.

At the outer side of the bearing, double labyrinth seals keep grease in, also keep dirt out. What's more, large grease reservoirs act as additional dirt traps.

. . . yet easy to grease

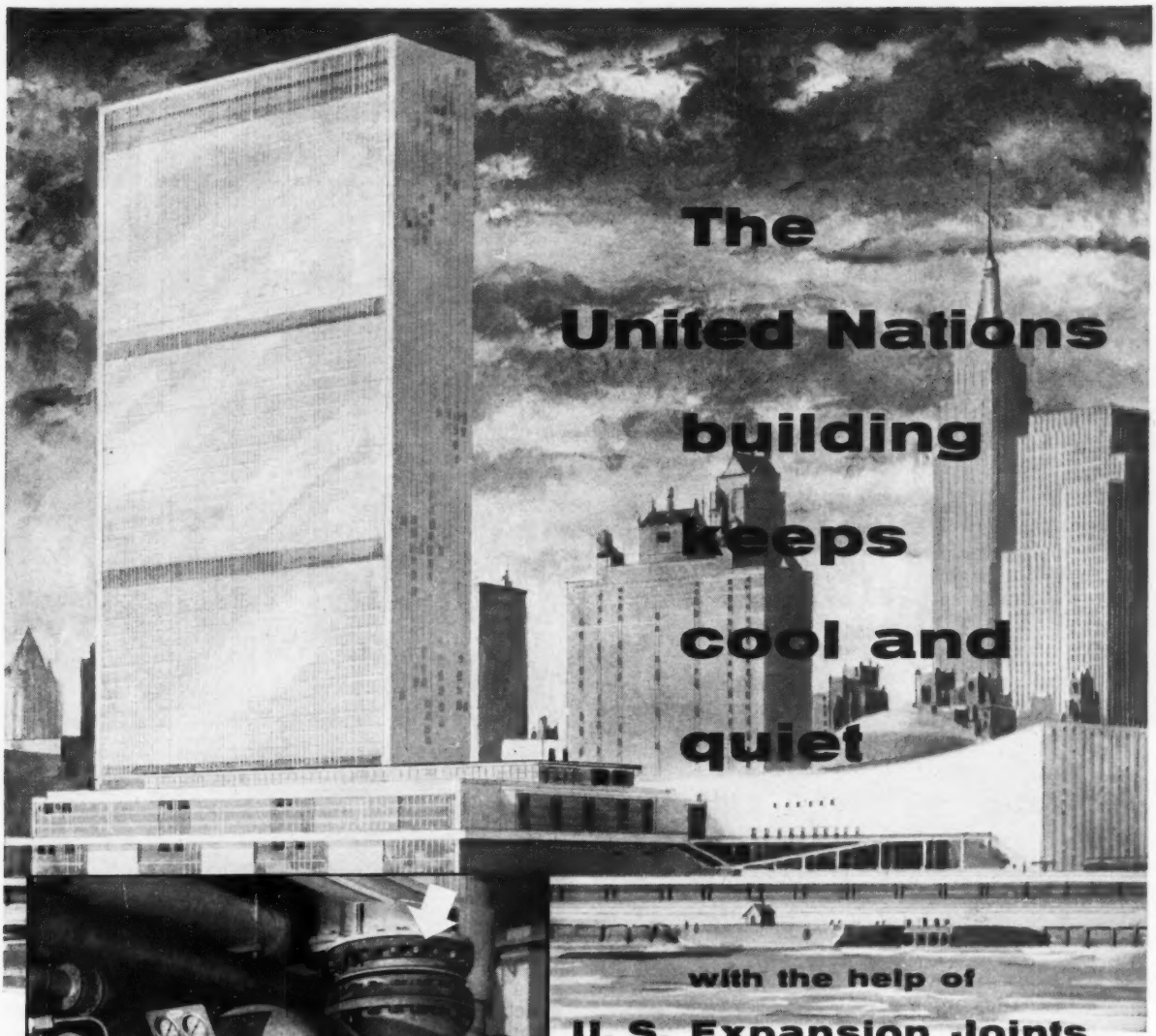
You can lubricate the bearings without dismantling the motor. Pipe-tapped holes in the bearing housings at three points provide both means for inserting new grease and a means of flushing out old grease.

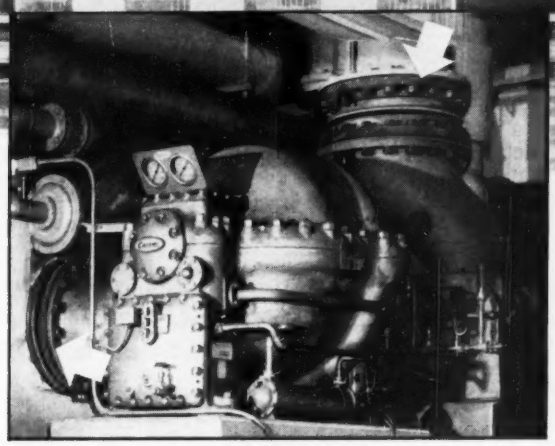


Look for the extra bolts on the end housing . . . the sign of greater value. Ask your Allis-Chalmers representative or Authorized Distributor to show you a cutaway section of this maintenance-cutting design. Or write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 51B7286.

A-4610

ALLIS-CHALMERS





with the help of

U. S. Expansion Joints

U. N. personnel remain cool and relaxed in their great edifice. The air-conditioning system is noiseless and vibration-free. Flexible rubber connections known as U. S. Expansion Joints "take up" any movement in the piping, effectively *hushing* and "calming down" vibration and pump noises in the system. In the photo, for example, you see one of the refrigerating compressors in the U. N. building. Note the U. S. Expansion Joints, one going out from the top of the turbine, the other from the side. U. S. Expansion Joints are also used for the chilled-water lines from the water chillers and the refrigerating lines from the refrigerating compressors; also on the water lines to and from the cooling towers.

A product of United States Rubber Company, these joints also offset stresses caused by expansion and contraction. Since they have no moving parts to wear or bind, U. S. Expansion Joints last a long time. Some are still in service after 30 years—a record unmatched by any other joint!

For air-conditioning systems, or in any pipe line where noise and vibration are problems, investigate U. S. Expansion Joints. Call any of the 27 "U. S." District Sales Offices or write address below.

US RUBBER

"U. S." Research perfects it..."U. S." Production builds it...U. S. Industry depends on it.

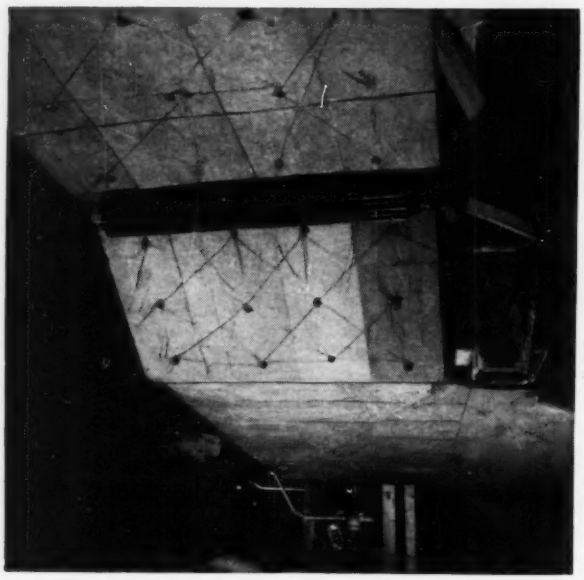
UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

Hose • Belting • Expansion Joints • Rubber-to-metal Products • Oil Field Specialties • Plastic Pipe and Fittings • Grinding Wheels • Packings • Tapes Molded and Extruded Rubber and Plastic Products • Protective Linings and Coatings • Conductive Rubber • Adhesives • Roll Coverings • Mats and Matting

EAGLE-PICHER
PV SUPERTEMP
BLOCK INSULATION

with the NEW *"Precision-Finish"*



A TRUE-CUT BLOCK! Eagle-Picher's new "precision-finish" is one of the most important insulation developments in years. Here's a highly efficient, all-purpose insulating block that is practically dustless.

GREAT STRUCTURAL STRENGTH! Eagle-Picher PV Supertemp Block meets your specific demands for long-lasting insulating block able to withstand a wide hot surface temperature range up to 1900 F. PV Block effectively resists steam and other moisture, does not disintegrate or lose thermal efficiency under heavy-duty service.

EASILY INSTALLED! Lightweight PV Supertemp Block is easy to handle, requires only minimum reinforcing. It is easily cut to fit irregular areas—and no special tools are needed.

WRITE FOR FREE SAMPLE TODAY!

Compare Eagle-Picher PV Supertemp Block with other insulating blocks. You'll appreciate the improved temperature control that pays off in greater fuel savings. You'll sell yourself on the new "precision-finish"!

Since 1843

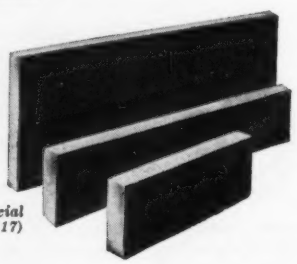
EAGLE EP PICHER

THE EAGLE-PICHER COMPANY

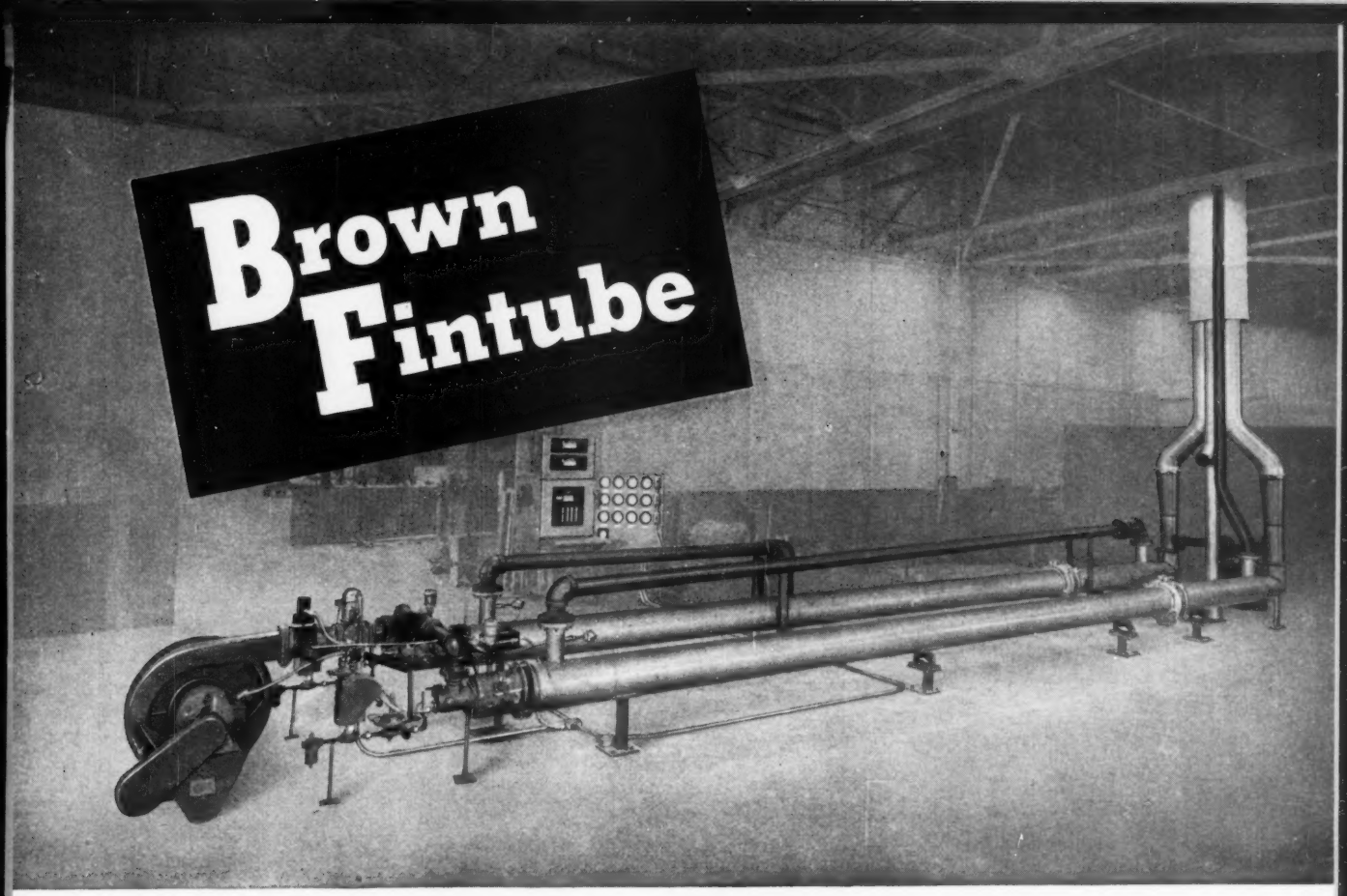
Producing a complete line of industrial insulations

Cincinnati 1, Ohio

(Member of Industrial Mineral Fiber Institute)



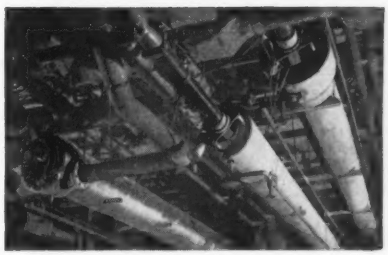
(Conforms to Commercial Standard CS 117)



Fired Indirect Heaters

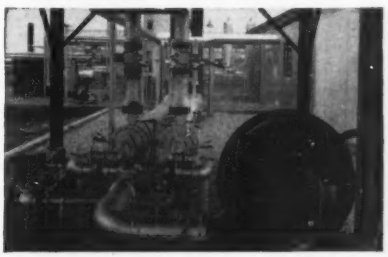
for heating air; special atmospheres; corrosive and non-corrosive gases; thermal chemicals; circulating oils; asphalt; for super heating vapors and other very exacting duties.

We can generally guarantee surface temperatures of the finned combustion tube, to a maximum of 200° F. above the maximum temperature of the liquid—this is extremely desirable when heating asphalt and certain other materials.



Above: Three Brown Fintube Air Heaters Mounted from Ceiling to Save Floor Space.

Below: Outdoor Installation of Two Gas Fired Heaters.



up to 10,000,000 BTU per hour
3 standard types . . .
gas, oil or combination burner

HEAT EXCHANGE SURFACE
BROWN FINTUBE
HEAT TRANSFER PRODUCTS

Write for Bulletin No. 551

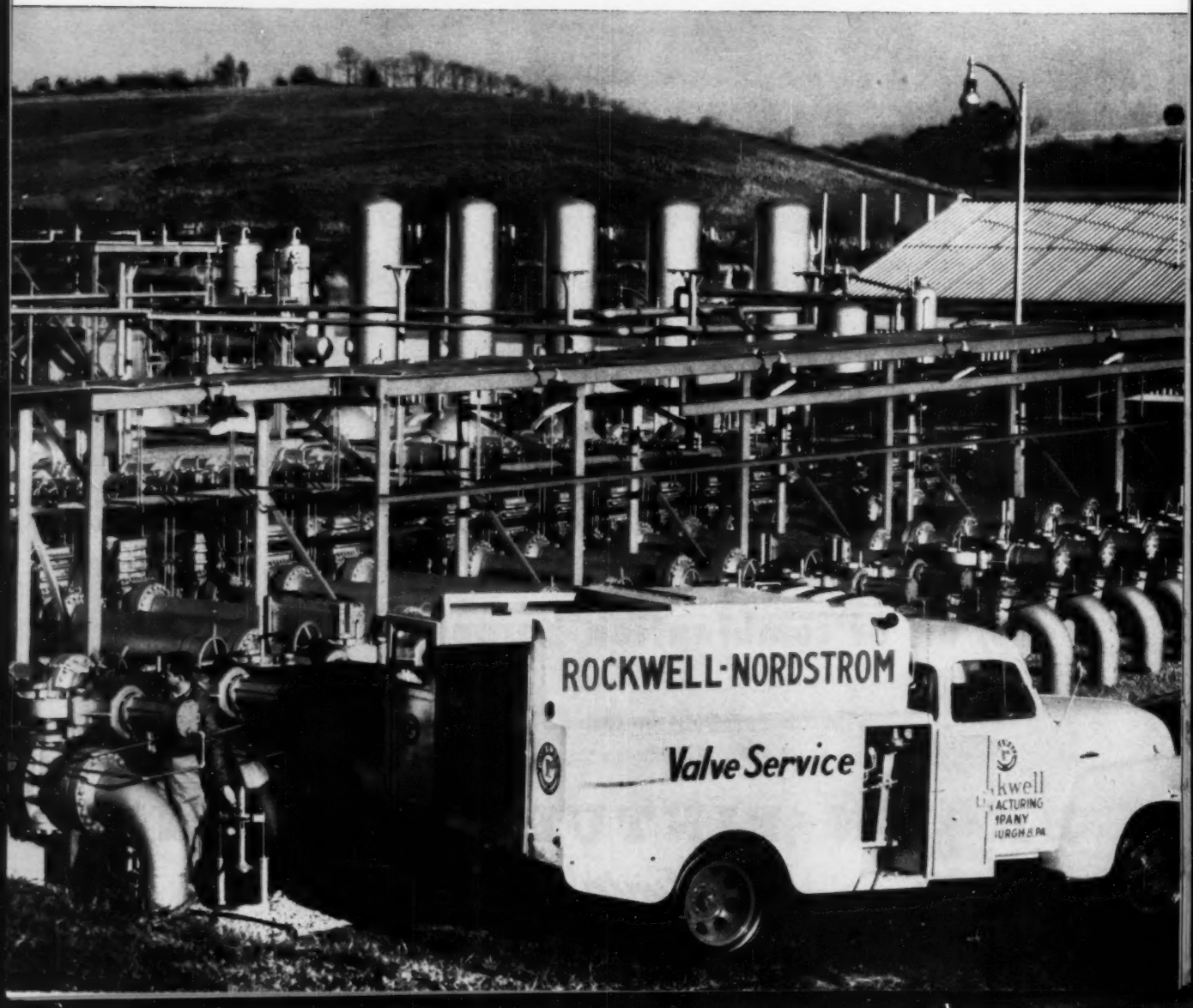
BROWN FINTUBE COMPANY

Elyria, Ohio

Engineering and Sales Representatives in the Principal Cities

NEW! Rockwell

A Mobile Service
For Low Cost
Contracted Valve Maintenance



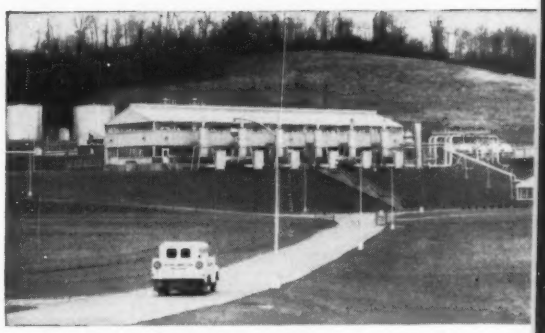
"Workshops on Wheels"

WHAT IT IS: Rockwell's new Mobile Maintenance and Lubrication Service is designed to increase the efficiency and lower the cost of valve maintenance for oil and gas field installations, refineries, pipe lines, chemical plants, and processing plants. It is made possible by a fleet of specially-built valve "workshops on wheels," manned by factory-trained experts, and equipped to provide complete "on the spot" service on a regular schedule, tailored to fit individual needs.

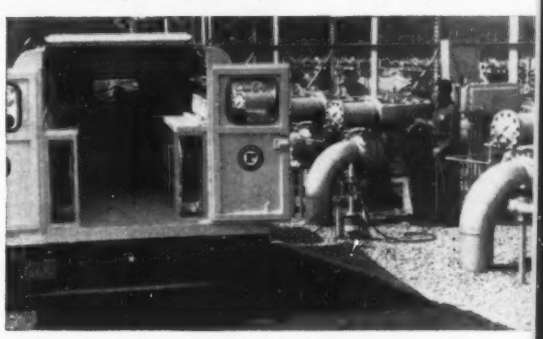
HOW IT WORKS: A Rockwell engineer, thoroughly familiar with Nordstrom valve design and maintenance, as well as with your particular process requirements, studies your installation in terms of its service needs. Then a mutually agreeable schedule is established for the servicing of your valves. From that time on, you have no valve maintenance worries; they become the responsibility of a Rockwell service expert. At regular intervals he will handle all servicing and lubrication quickly, efficiently, working from one of Rockwell's "workshops on wheels." These Rockwell-designed trucks are equipped with the most advanced lubrication, servicing and repair equipment, and built to operate with complete safety under any fire or explosion control requirements.

WHAT IT COSTS: Naturally, the price of this new planned maintenance and lubrication service varies with the size and number of valves, and with frequency of service. Definite prices are established after a Rockwell engineer has studied your individual requirements.

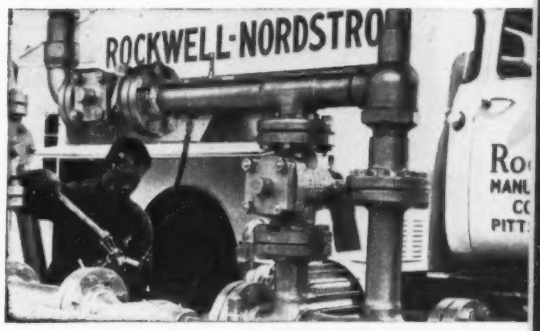
Actually, this new Rockwell service saves far more than it costs. It saves on fixed maintenance overhead. It saves on valve repairs. It saves by reducing costly down time. Because it is expert *preventive* maintenance performed on a regular schedule, it saves by spotting potentially expensive trouble *before* it gets expensive. And, of course, it saves on valve replacement costs because your valves will give you longer, more economical service life.



Pre-planned "on-the-spot" lubrication and service . . .



. . . performed by scientifically equipped experts . . .



. . . cuts maintenance, down time, and replacement costs.

The new Rockwell Mobile Maintenance and Lubrication Service is another extra value you can get only from the world's oldest and largest maker of lubricated plug valves. Its sole purpose is to help you get the best possible valve service at the lowest possible cost. For more detailed information, send the coupon below.

ROCKWELL-
Nordstrom VALVES

LUBRICANT SEALED FOR POSITIVE SHUT-OFF

Rockwell Manufacturing Company
400 N. Lexington Avenue
Pittsburgh 8, Pennsylvania

☐ Please send me complete information about Rockwell's new Mobile Service.

☐ Please have a Service Engineer survey my valve maintenance needs.

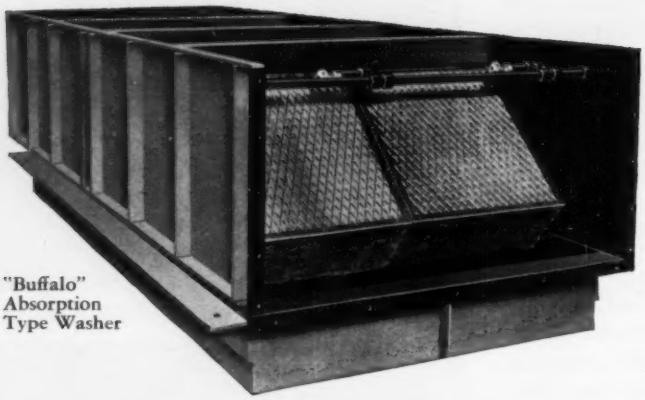
Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

How BUFFALO Can Help You with Your AIR CLEANING Jobs



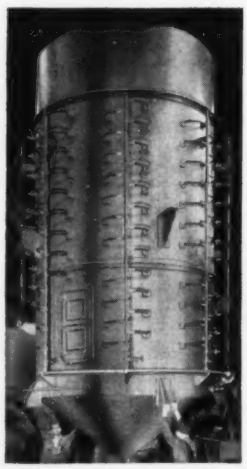
"Buffalo" Absorption Type Washer

With the country becoming more and more pollution-conscious, industry calls on Engineers with many "puzzlers" in the way of air-cleaning problems. Here at "Buffalo", with over half a century of experience in this field — and a wide line of equipment — we are in an excellent position to help. Our files include a tremendous variety of problems successfully solved, with new information being added almost daily. "Buffalo" Engineers are constantly developing highly specialized equipment for new and specialized problems.

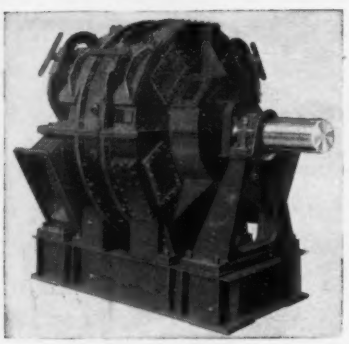
EXAMPLE — a collection efficiency of 99.9% plus, ending a serious nuisance problems in phosphate rock drying operations.

EXAMPLE — 1000° F. highly corrosive gas effluent made nuisance-free and non-toxic.

EXAMPLE — tar vapor, lampblack, metallic fumes in concentrates of 5 to 10 grains per cu. ft. removed to average of .006 grains per cu. ft. in numerous installations.



"Buffalo" Hydraulic Scrubbing Tower



"Buffalo" Rotary Gas Scrubber

"Buffalo" equipment includes Air Washers, Hydraulic Scrubbing Towers, Hydro-Volute Scrubbers, Rotary Multi-stage Gas Scrubbers, Gas Absorbers, Blowers, Exhausters and Pumps to solve most any cleaning problem you may have — all engineered to the job, for highest efficiency and simplest possible maintenance. Call on the "Buffalo" Air Engineer in any principal city for sound, helpful recommendations.

WRITE FOR BULLETINS AP-225, AP-425, AP-525, 3181-B, and 2424-F.

"Buffalo" SALES ENGINEER AIR CLEANING

BUFFALO FORGE COMPANY

501 BROADWAY BUFFALO, N. Y.

Publishers of "Fan Engineering" Handbook

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Sales Representatives in all Principal Cities

"Buffalo"

VENTILATING • HEATING • AIR CLEANING
AIR TEMPERING • INDUCED DRAFT • EXHAUSTING
COOLING • FORCED DRAFT • PRESSURE BLOWING

THE NEW **CHIKSAN**

Hydraulically Controlled

MARINE LOADING ARM

The first basic improvement for loading and unloading of petroleum products in over 30 years.

- Speeds tanker turn-around-time
- Far less manpower to operate
- Long life, trouble free operation
- Elimination of hose bursts
- Lowers fire and work compensation premiums
- Operates from −60°F. to +225°F.
- One motor, one switch controls operation
- Static and spark resistant
- No manhandling of hose

CHIKSAN COMPANY; Brea, California

Please send me more information on the Chiksan Marine Loading Arm.

Name_____

Company_____

Address_____

City_____ Zone___ State_____

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CHIKSAN

A SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

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CHIKSAN COMPANY — BREA, CALIFORNIA • CHICAGO 3, ILLINOIS • NEWARK 2, NEW JERSEY

Well Equipment Mfg. Corp. (Division), Houston 1, Texas · Subsidiaries: Chiksan Export Co., Brea, Calif., Newark 2, N. J. · Chiksan of Canada, Ltd., Edmonton, Alta.

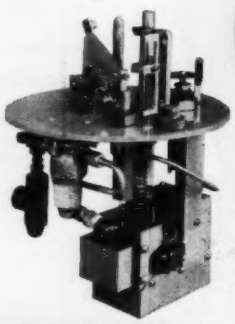
NEW control valve operator

accurately positions valve WITHOUT COMPRESSED AIR!

Controllers for process variables like pressure, temperature, flow, and liquid level can now be manipulated without air supply and compressor systems. The new 'American-Microsen' Control Valve Operator positions conventional slip-stem control valves with positive *electro-hydraulic* action. It now makes available a fully-integrated, graphic-type process control system *operated entirely by electricity*. It accepts the 0.5 to 5.0 ma. d-c signal of the 'American-Microsen' Electronic Process Control System. Signals received by the Valve Operator may include proportioning, reset, and rate actions to control, ratio, program, etc. There is no valve "flutter", even with greatly varying stem thrust; and position accuracy is quickly established by an integral electronic feedback system.

The Control Valve Operator is especially desirable where transmission distances are long . . . where freezing or clogging of pneumatic lines are problems . . . where the cost of air supply systems is excessive. Controls and Valve Operator can be up to 30 miles from the transmitter; the high-level signals are unaffected by ordinary transmission variations or ambient conditions.

Learn exactly how the new 'American-Microsen' *Electro-Hydraulic* Control Valve Operator can contribute to your process efficiency, product quality, and profitable operation. Write for data.

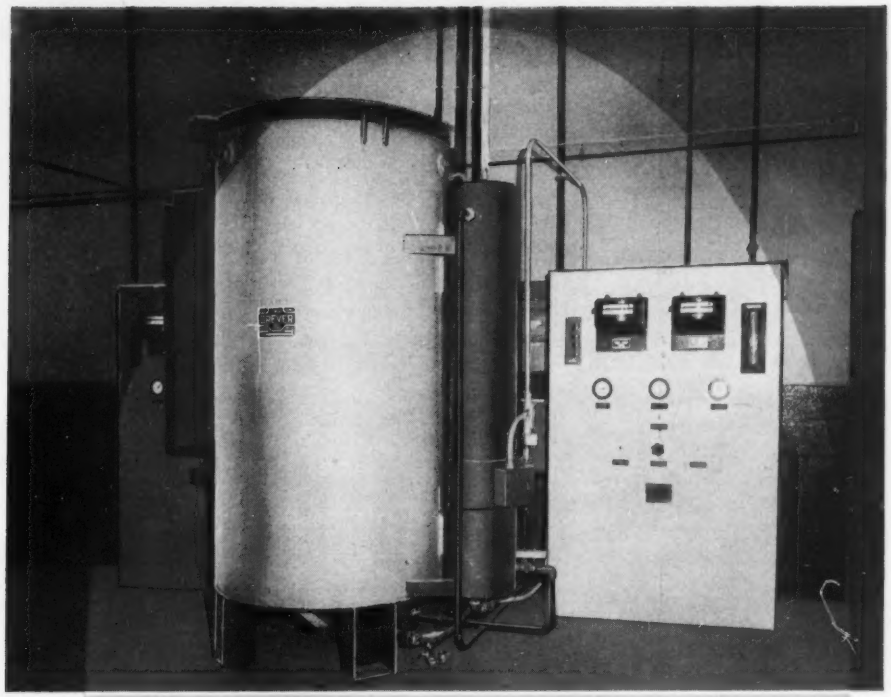


Interior working view

MANNING, MAXWELL & MOORE, INC.

INDUSTRIAL CONTROLS DIVISION, STRATFORD, CONNECTICUT

MAKERS OF 'AMERICAN-MICROSEN' ELECTRONIC TRANSMITTERS, INDICATING OR RECORDING SET STATIONS, CONTROLLERS, MANUAL CONTROL STATIONS AND ELECTRO-PNEUMATIC VALVE POSITIONERS.



"Cracked" Ammonia shows tremendous cost saving and unsurpassed performance

1. Hydrogenation of fats and oils
2. Industrial furnace atmosphere for treatment of various metals and alloys
3. Process operations where 25% nitrogen diluent is not harmful

the Drever

Ammonia Dissociator

Produces clean 75% Hydrogen Gas Mixture

We can supply COMPLETE STORAGE SYSTEMS for tank car lots of anhydrous ammonia. This reduces the cost of ammonia approximately 75%. *Write for bulletin B-52*

DREVER COMPANY

RED LION ROAD & PHILMONT AVE. • BETHAYRES, PA.

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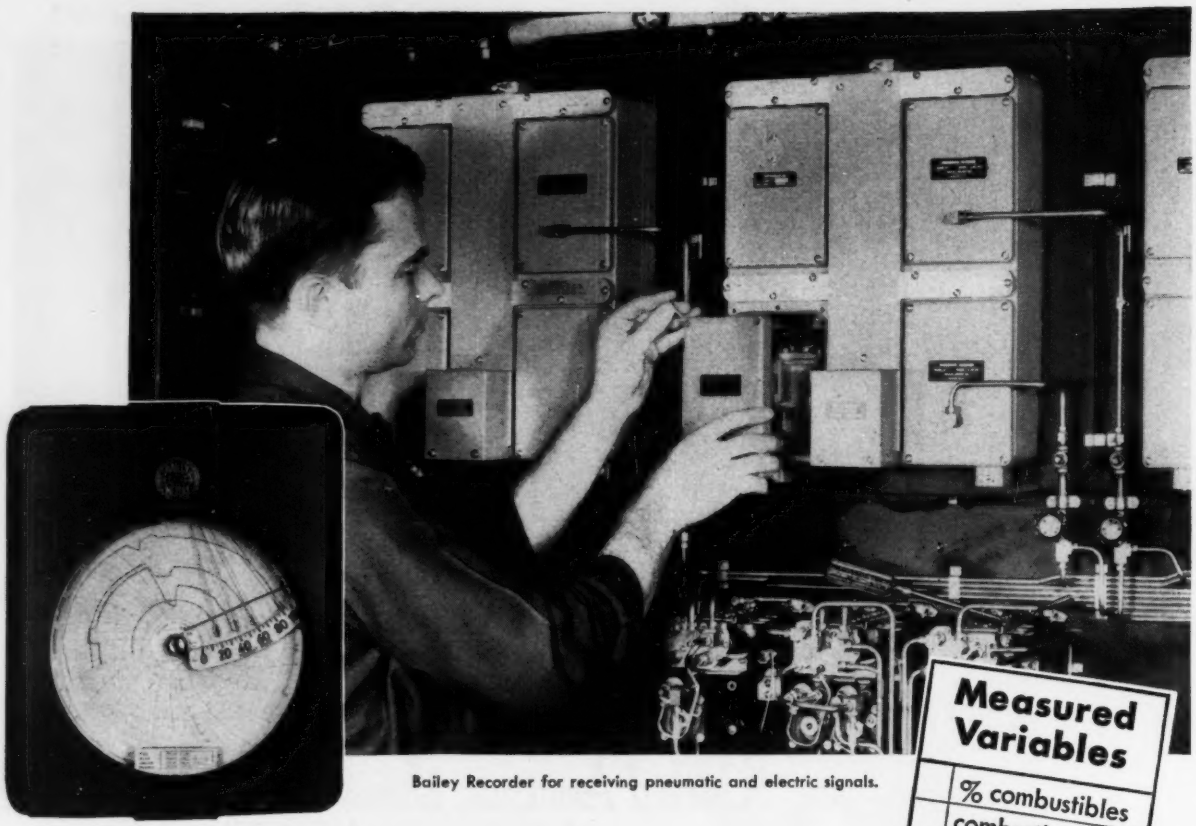


Bailey Recorder for receiving pneumatic and electric signals.

Pick any four, plug in, and record

Here is a receiver recorder, custom-built *by you* to meet your needs, no matter how changeable, how complex. On a single chart you can record any four measured variables—and interchangeable receivers permit new combinations almost at will.

Individual plug-in pneumatic or electronic receivers—and corresponding integrators—are interchangeable in the four identical frame slots. You can select any combination; even including two receivers and their two integrators.

Think what this can mean to you! Parts inventories are minimized; re-use of components keeps instrumentation costs economically low when cycle changes are frequent—and you can even tie in with your existing transmitters.

Ask for Product Specification E12-5.

Measured Variables

- % combustibles
- combustion
- conductivity
- density
- differential
- draft
- flow
- liquid level
- % oxygen
- pH
- position
- pressure
- ratio
- smoke density
- specific gravity
- speed
- temperature
- vacuum

PBB-1

ONLY BAILEY OFFERS ALL THESE ADVANTAGES IN A SINGLE RECORDER

- Pre-calibrated plug-in receiver units
- Up to four pneumatic or electronic receivers —or two receivers and two integrators
- Any four variables on one chart—easily read and interpreted
- A full year's ink supply at one loading
- Faster ordering—from stock
- Minimum inventory of parts
- Minimum instrument investment for process cycle expansion or alteration

BAILEY METER COMPANY

1054 IVANHOE ROAD

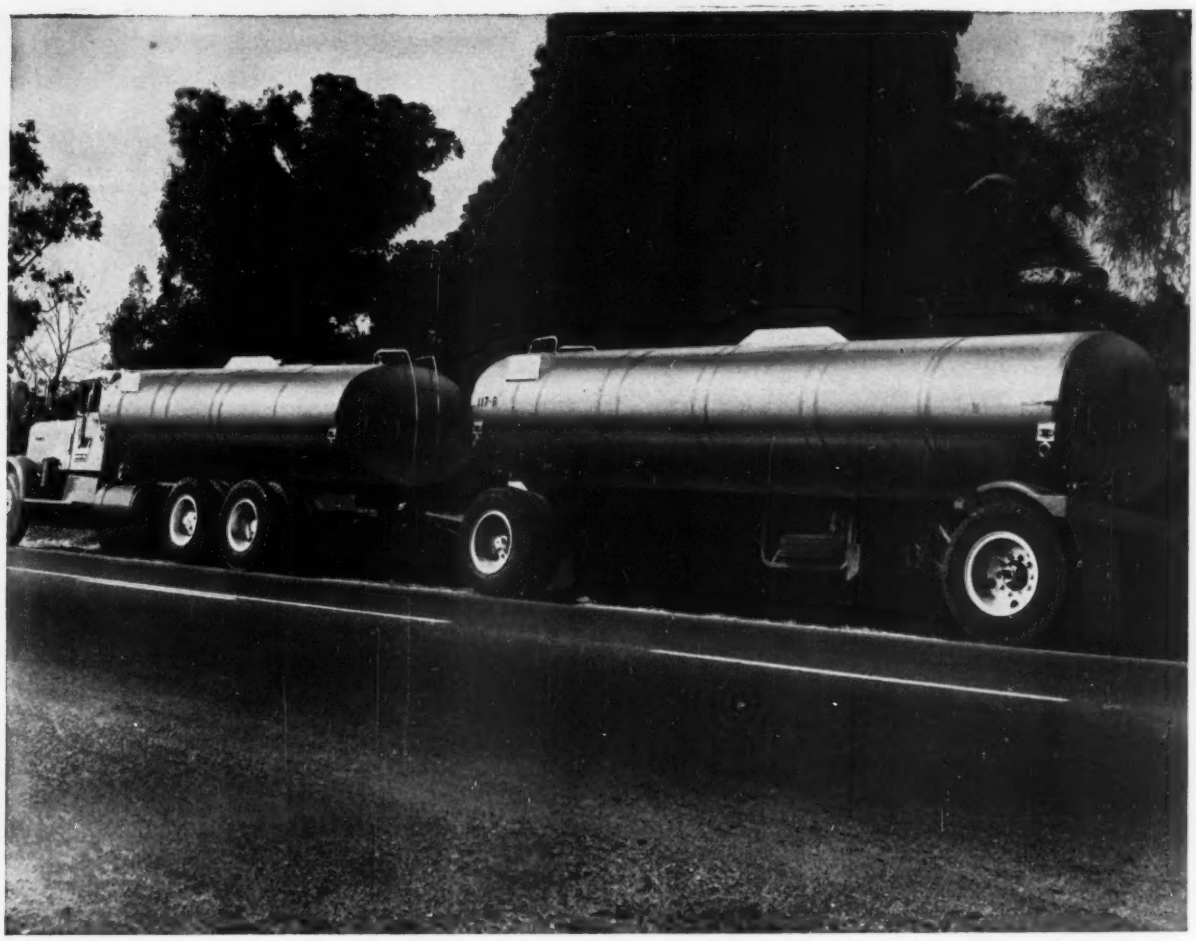
CLEVELAND 10, OHIO

Controls for Power and Process

BAILEY METERS

Controls for

TEMPERATURE
PRESSURE
GAS ANALYSIS
FLOW · LEVEL
RATIO · DENSITY



Tank Trailers of Armco Stainless Carry Pay Loads *Both* Ways

Trucking companies have found that truck tanks made of Armco Stainless Steel pay for their extra cost in a very short time. The reason is they carry pay loads on return trips as well as outbound trips. Stainless Steel tanks can be switched from one fluid to another. Their smooth, corrosion-resistant interiors are easily cleaned and freed from odor or possibility of contamination.

For example, a West Coast tank truck manufacturer reports that many units are hauling gasoline to Arizona, returning with aqua ammonia or cottonseed oil, thereby paying for the back haul.

WIDE VARIETY OF CARGO

Stainless steel truck tanks carry cargo like alcohol, glycerine, resins, cocoanut fat, phosphoric acid, tallow, ethylene bromide, petroleum products and a variety of chemicals. Type 316 and Type 316L Armco Stainless Steels are ideal.

By the use of sanitary baffles, they can haul wine, vinegar, water, liquid sugar, vegetable oils and molasses. In the hauling of aviation fuel and high octane gas, stainless steel tanks completely eliminate sedimentation tests.

For complete information on Armco Stainless Steels, write us at the address below.

ARMCO®

ARMCO STEEL CORPORATION 1565 CURTIS ST., MIDDLETOWN, OHIO

SPECIAL STEELS

SHEFFIELD STEEL DIVISION • ARMCO DRAINAGE & METAL PRODUCTS, INC. • THE ARMCO INTERNATIONAL CORPORATION

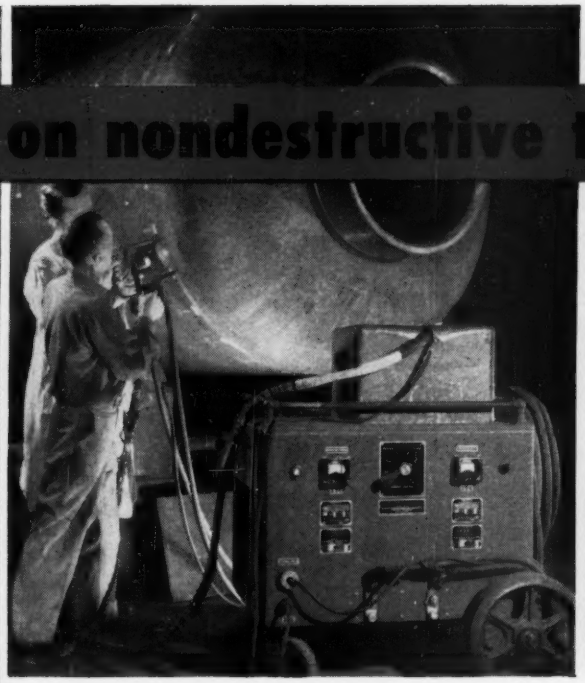
A. O. Smith reports

Radiography is perhaps the most important inspection method A. O. Smith uses to detect flaws in welds and adjacent plate material. The products of A. O. Smith — ranging from critical ordinance and atomic energy equipment to pressure vessels and heat exchangers — require radiographic inspection of light gauge thickness and heavy wall thicknesses exceeding 6 inches. We make use of both x-ray and gamma-ray inspection and both methods record on film the density variables characteristic of unsound material. Technician is shown x-raying the longitudinal seam of an alloy-lined shell.

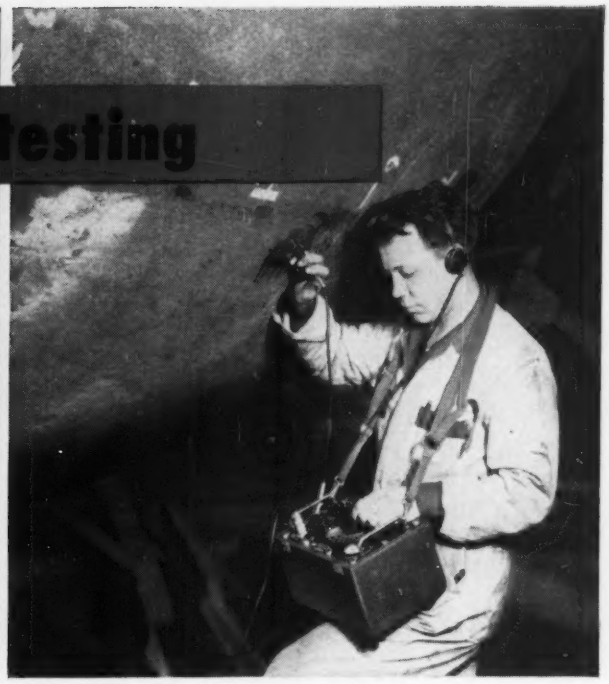
Skilled interpretation of the film is, of course, the key to successful radiographic inspection. If all the film developed and interpreted at A. O. Smith since 1932 were laid end to end, the strip would extend over 1,224 miles.

Important applications for nondestructive tests are those that determine acceptability of materials for specific corrosion-resistant or welding characteristics. Sulphur printing, illustrated here, is one of the control inspections used by A. O. Smith. The test is designed to determine the amount and segregation of sulphur present in forgings. This inspection evaluates the forging for welding.

on nondestructive testing



Still another method of flaw detection used by A. O. Smith is the magnetic particle test. Magnetic particle tests are ideal for detecting surface and sub-surface faults in ferrous materials. In this picture, technicians are shown inspecting the welds on a pressure vessel.



Ultrasonic testing (inspection utilizing high-speed sound waves) is another method A. O. Smith uses for quality control of heavy sections. The picture shows an additional application of ultrasonic testing — operator is determining wall thickness of 167,000-lb. vessel.

Nondestructive inspection is one more reason for the dependability of A. O. Smith vessels, exchangers and other process equipment.

The man in charge of A. O. Smith's nondestructive testing . . .

A. Cota. With A. O. Smith for more than 27 years, Mr. Cota has specialized in nondestructive testing since 1932. He has been a leading force in the development of many of the techniques and procedures now used throughout industry. He is past-president of the National Society for Nondestructive Testing . . . is serving on nondestructive testing committees of ASME and ASTM and in various other control groups. This experience is another reason why it's wise to call A. O. Smith *first* for processing equipment.

Illustrated here are just a few of the nondestructive testing processes by which A. O. Smith maintains the quality of its products. Of course, there are many other tests, too — both nondestructive and destructive — all designed to help create equipment that will excel in your operations.

A. O. Smith was one of the members of the original committee that first established radiographic inspection techniques and standards. Also, we have used magnetic particle testing since 1934 . . . ultrasonic testing procedures since 1945.

Through research A.O. Smith *. . . a better way*

A.O.Smith

CORPORATION

PROCESS EQUIPMENT DIVISION
HEAT EXCHANGERS • PRESSURE VESSELS
Milwaukee 1, Wisconsin

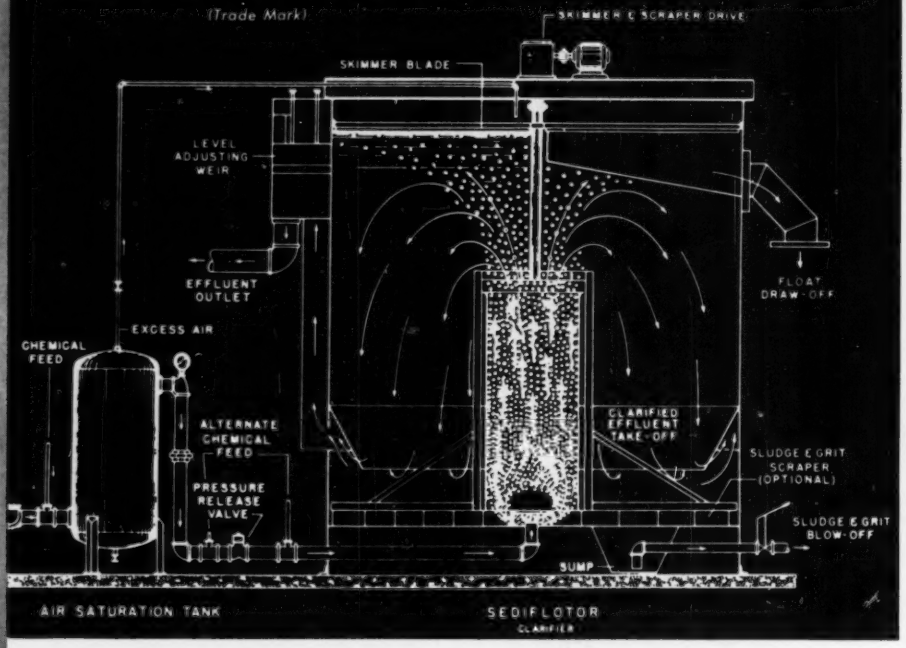
International Division: Milwaukee 1, Wisconsin

NOW INFILCO ...LEADER IN WASTE-TREATMENT EQUIPMENT ENGINEERING presents the

SEDIFLOTOR Clarifier

(Trade Mark)

versatile new 2-in-1 flotation unit



1. "DISSOLVED-AIR FLOTATION" assures rapid removal of suspended material from waste waters. Here is new efficiency for removing contaminants such as oils, greases, light fibrous materials, etc. Based on the principle of "dissolved-air flotation"— and incorporating reliable chemical feed and operating control, the "SEDIFLOTOR" Clarifier is the answer to many waste problems.

2. GRAVITY-SETTLING CLARIFICATION is included. "SEDIFLOTOR" Clarifier design provides the most modern type of gravity-settling equipment, so that both light and heavy materials are removed rapidly and effectively.

Faster...flexible...economical...dependable

Proved by exhaustive test, "SEDIFLOTOR" Clarifier offers marked advantages. The combination of flotation and gravity-settling results in extremely fast and efficient cleansing of waste waters from refineries, packing houses, paper mills, sewage plants (where large amounts of grease and oil are present), chemical and food plants and other similar sources.

It is readily adaptable for use with other equipment, and may be designed for literally any desired flow, with provisions for use of chemical agents, and continuous removal of floating scum and settleable solids.

Quite automatic, the "SEDIFLOTOR" Clarifier operates with maximum economy and requires only periodic attention.

Waste Samples Invited

Our laboratory is equipped to test samples of waste water to determine suitable methods and proper size of equipment for your needs. Your inquiry is invited and should include general description of your problem.

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The one company offering equipment for all types of water and waste treatment—coagulation, precipitation, sedimentation, filtration, flotation, aeration, ion exchange and biological processes.

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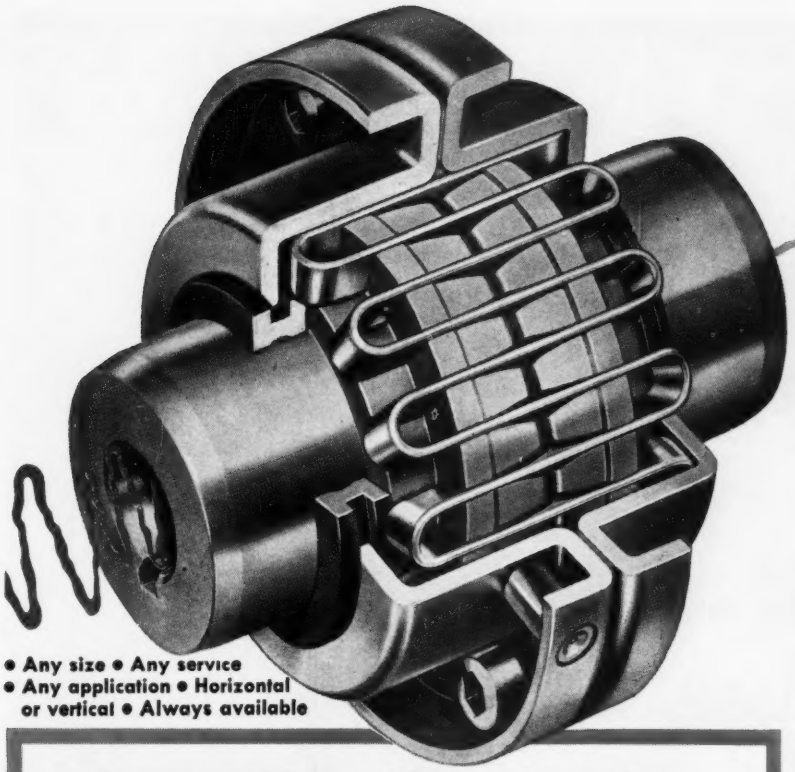
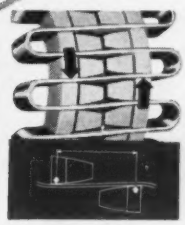


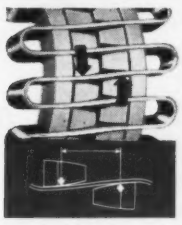
• Any size • Any service
• Any application • Horizontal or vertical • Always available

Exclusive FALK Steelflex grid-groove design smothers shock and vibration.

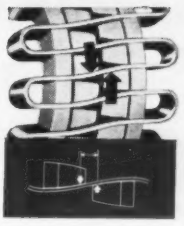
The damaging effects of shock and vibration can shorten the life of any connected machinery. Here is how the Steelflex grid-groove design overcomes these common enemies.



Under LIGHT LOADS
The gridmember bears only at outer edges of grooves. The long span between points of contact remains free to flex under load variations.



Under NORMAL LOADS
As load increases, the distance between supports on the grooves is shortened proportionately, but a free span remains to cushion shock loads.



Under SHOCK LOADS
Under extreme overloads, the grid-member bears fully on the grooves and transmits full load directly. The coupling remains flexible, within its rated capacity.

Why FALK Steelflex Couplings give the *finest* protection for connected machinery

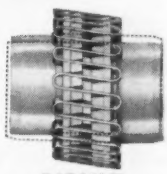
Maximum protection of connected machinery is best provided by Falk Steelflex Couplings because, thanks to their exclusive design, they overcome the damaging conditions of shock loads, shaft misalignment and vibration. How this unique multiple protection is made possible is shown at the right.

Falk Steelflex Couplings give the most economical protection, too, because they make connected machinery last longer and give better service. Furthermore, when actual coupling costs are figured per year of service, Falk Steelflex Couplings show substantial savings through their rugged all-steel construction, easy interchangeability and low maintenance requirements.

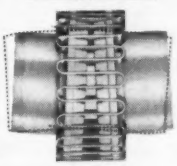
The basic Type F Steelflex Coupling—in 33 sizes to cover capacities from 2/5 through 70,000 hp per 100 rpm—meets over 90% of all industrial applications. Special or Dual Purpose Steelflex Couplings are available for problem applications. Write to Department 247 for engineering bulletin, including selection and dimension details.

...Accommodates shaft misalignment and free end float

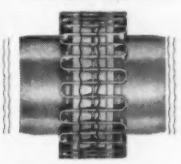
Basic maintenance procedure dictates regular inspection and correction of shaft alignment. Between inspections, Steelflex couplings provide protection by accommodating unavoidable shaft misalignment and end float. The gridmember which connects the two hubs of a Steelflex coupling is not fastened to either hub, so each hub can shift without imposing load on the other shaft.



PARALLEL MISALIGNMENT



ANGULAR MISALIGNMENT



FREE END FLOAT

THE FALK CORPORATION, Milwaukee 8, Wisconsin

MANUFACTURERS OF

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- Speed Reducers
- Flexible Couplings
- Shaft Mounted Drives
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FALK

...a good name in industry

YOU CAN DEPEND ON THE Richardson E-50!

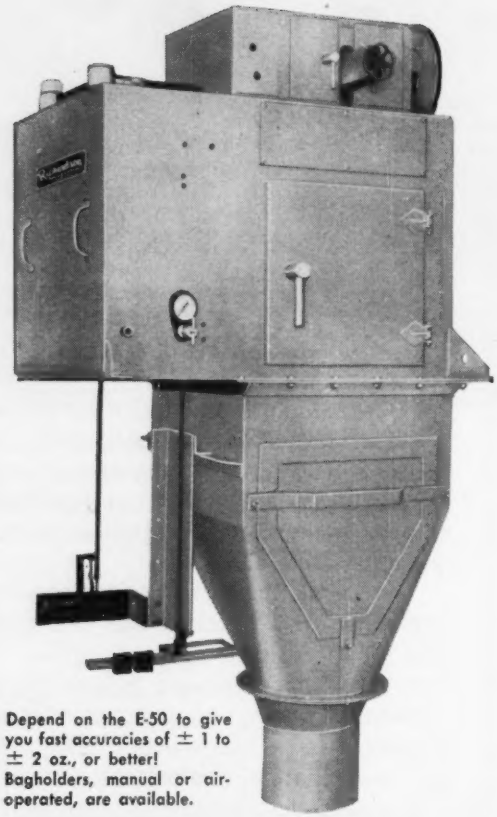
When the weighing is fast and the materials are loose (or even sluggish!), and you're having a running battle with profit loss from weight inaccuracy or the high cost of bagging and scale upkeep . . .

here's one scale that won't let you—or your profits—down!

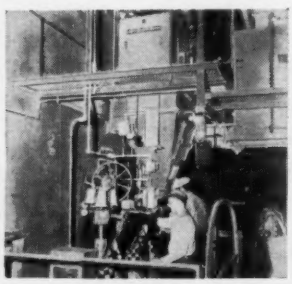
IT'S DEPENDABLE! The E-50's work-horse dependability makes it the perfect choice for any plant *where output vitally depends on the perfection of the bagging scale.* And upkeep is low! You'll find Richardson Scales still in operation after 30 and more years of service.

IT'S FAST, ACCURATE! With the rugged, completely automatic Richardson E-50 you'll get high speed bagging with accuracies *that never before were a practical possibility*—up to 1/10 of 1% under optimum conditions.

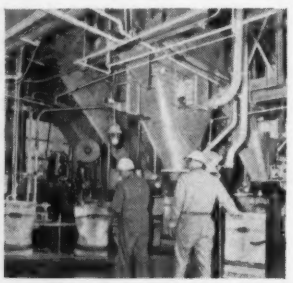
IT'S VERSATILE! Unique design permits the weighing of hundreds of food, chemical, grain and other materials. The E-50 is equally efficient as an independent bagging machine, or as an integral part of a co-ordinated production line packaging system. Don't let weight inaccuracy and bagging costs pick your pockets. Find out about the scale that really unties production tie-ups—Richardson E-50. Write today for free illustrated bulletin #3749A that tells the whole cost-saving E-50 story!



Depend on the E-50 to give you fast accuracies of ± 1 to ± 2 oz., or better! Bagholders, manual or air-operated, are available.



Duplex Model E-50 bags poultry mash up to twenty-two 50-lb. bags per min. at leading feed mill.



Ten 50-lb. bags per min. of antibiotic are delivered from Duplex E-50 in major pharmaceutical plant.

Richardson

MATERIALS HANDLING BY WEIGHT SINCE 1902

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. . . with *union* body-bonnet joint on 125 lb., 150 lb., 200 lb. pressure classes

Be safer—and save! Greater operating safety, positive shutoff, and low upkeep costs are the prime advantages of modern OIC bronze gate valve designs in all pressure classes.

Union ring nut provides safety-tight body-bonnet joint

The separate union nut seals the bonnet and body mating surfaces, effecting a tight, leak-proof joint. Possibility of distorting body and bonnet during disassembly and assembly and of loosening the joint during operation are virtually eliminated.

OIC design reduces maintenance costs

Necessity for stem replacement can be forgotten, because stems are special, long-lived OIC *Alloy-40*. This sturdy material eliminates galling and seizing and contributes to easy operation.

Stem threads are never exposed to line fluids in open or closed positions (125 lb. and 150 lb.), preventing thread abrasion from line fluids or suspended solids.

All pressure parts are designed for maximum strength, and working parts are hydrostatically tested for positive sealing and seating. Write for our folder, No. 1006. ***Order from your OIC distributor.***

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VALVES | **FORGED & CAST STEEL, LUBRICATED PLUG, BRONZE & IRON VALVES**

for TOUGH fluid and gas handling jobs

ATLANTIC

FLEXIBLE METAL HOSE

Conveying nitric acid for use in batch nitrations is quick death for ordinary flexible metal hose. Sulphuric acid and plating solutions are other notorious killers. When temperature and pressure extremes and adverse handling conditions are also involved, hose replacement is frequent and expensive.

That's why—for tough jobs—it's good economy to specify Atlantic flexible metal process hose. Manufactured to survive the most destructive use, it is unequalled for leak-proof qualities, flexibility, durability, strength and lightness. It performs long after ordinary hose is scrapped and returns real savings in your material and labor dollar.

Whatever your application — conveying, controlling movement and vibration, correcting misalignments, compensating for expansion and contraction — *there is an Atlantic flexible metal hose that is best for it.*

Available in Seamless or Interlocking construction: Steel, stainless steel, monel, bronze. ⅛"—36" I.D. Inclusive with appropriate fittings.

Our engineers have developed flexible metal hose for a number of classified nuclear applications. Though these types cannot be released at present, the experience gained is available for any unusual problems you may have.

Write for Chemical and Process Industries Bulletin 20D.

See our Catalogs in Sweet's Files for Product Designers and Mechanical Industries.

ATLANTIC METAL HOSE CO., INC.
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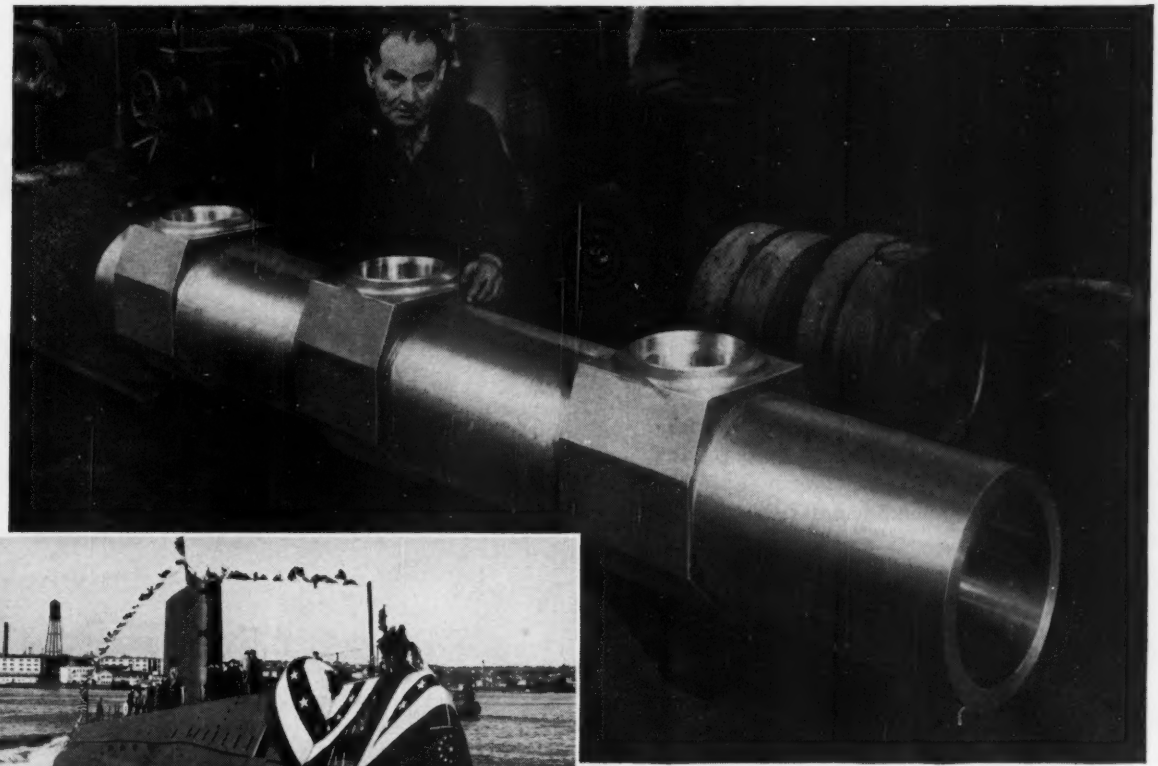
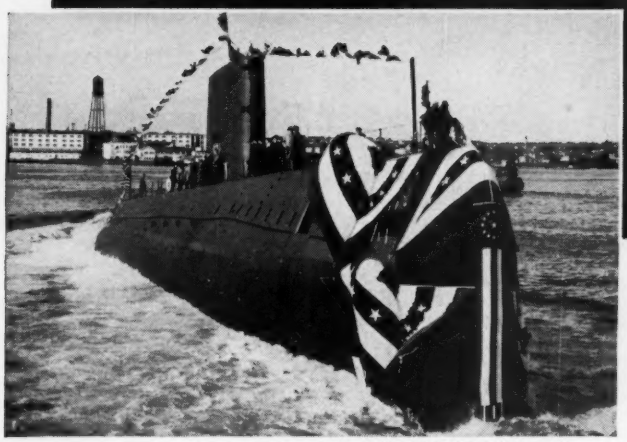
MIDVALE FORGES STAINLESS STEEL





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To Harness Atomic Power Underseas

In planning atomic-powered submarines, top-grade materials and top-quality workmanship were first considerations throughout.

Midvale is proud to have supplied the stainless steel forgings used in the heat exchanger system of the power reactor . . . proud because of the recognition thus given to Midvale quality . . . in steel making, in forging, and subsequent heat treatment, inspection and testing.

These forgings of type 347 stainless steel required the most careful control in the melting and casting of the ingots, together with the best in forging technique to produce material that would pass all of the exacting metallurgical requirements. The 100% Zyglo inspection, inside and out, was only part of the specifications. All forgings were fabricated by welding into the piping system and heat exchanger.

It will pay you, too, to call Midvale for any forging . . . carbon, alloy or stainless steel . . . any shape — rolls, gear rings, shafts, pressure vessels or a variety of other steel products.

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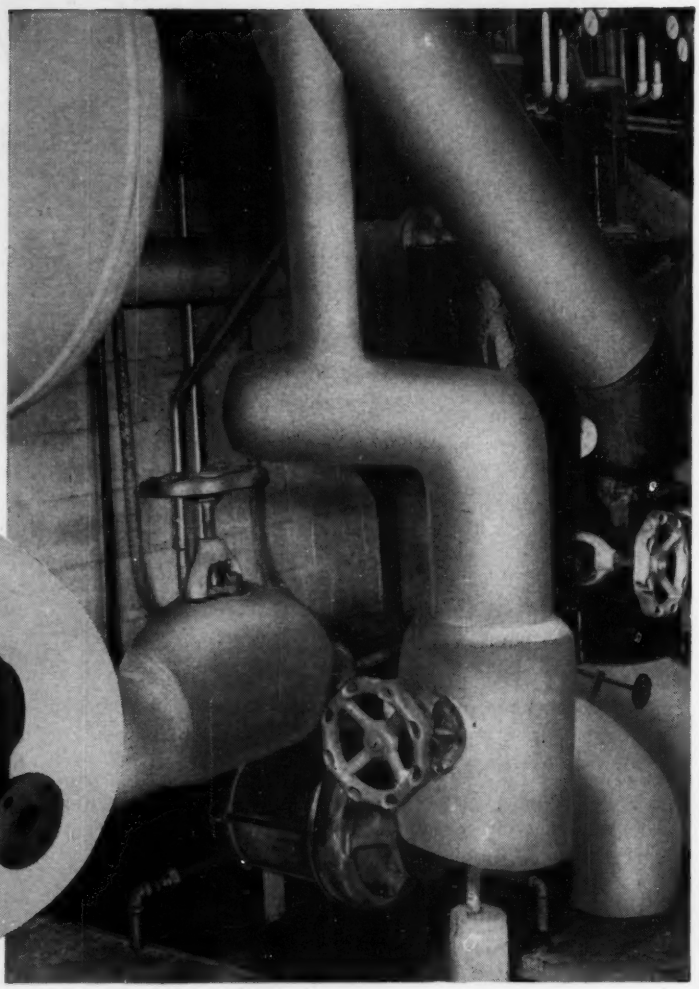
FORGINGS, ROLLS, RINGS, FLANGES, CORROSION AND HEAT RESISTING CASTINGS

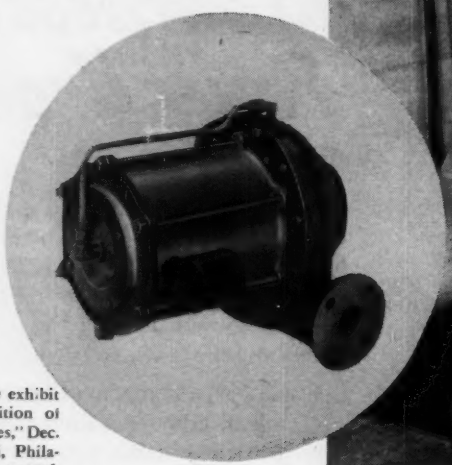
★ **no seals...no stuffing box**

Chempump



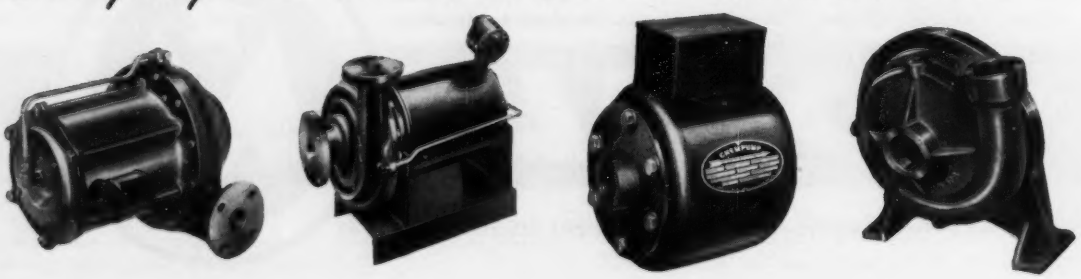
Chempump installed in American ENKA's Nylon Research Pilot Plant, Enka, North Carolina. 1 hp pump handles *Dowtherm* at temperature of 520°F.

Pump capacity: **60 gpm.**
Discharge head: **30 ft.**



DON'T FORGET
to visit the *Chempump* exhibit at the "25th Exposition of the Chemical Industries," Dec. 5-9, Convention Hall, Philadelphia, Booths 314 & 316.

Chempump—first in the field . . . process proved



for hard-to-handle HOT OILS

pumps heat transfer fluids, hot vegetable and mineral oils, silicone fluids . . . without leakage or contamination

Hot oils are often hard to handle with conventional centrifugal pumps. Low surface tension and increased wetting action increase the problems of leakage, fluid loss, contamination, and maintenance. Besides being messy and expensive, leakage can present a real danger with some fluids.

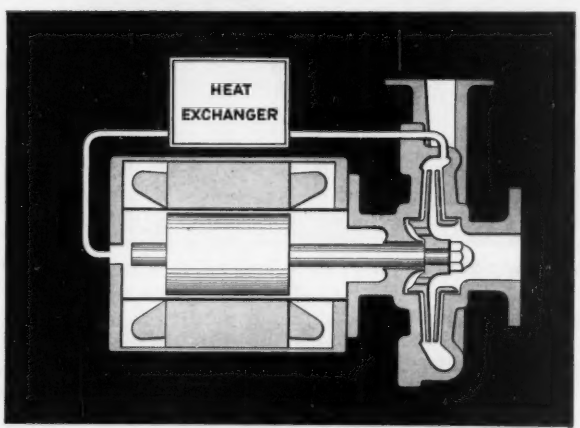
Chempump, by its very design, prevents these problems. With no shaft sealing device of any sort, *Chempump* can't possibly leak! Absence of a stuffing box means no packing lubricant—therefore no contamination even under extreme vacuum or pressure . . . especially important when handling hot vegetable oils.

Chempump can handle fluids at temperatures up to 450°F without need for special cooling devices. Use of a simple heat exchanger in the circulating line permits pumping of hot oils from 450°—700°F.

Chempump's seal-less design combines pump and motor in a single hermetic unit. Pump impeller and rotor are an integral unit. Statically and dynamically balanced, the rotor-impeller combination forms the only moving part. Pumped fluid enters the rotor chamber, isolated from the stator section by a corrosion-resistant, non-magnetic liner. No shaft sealing device is required.

Chempump seal-less pumps are proving their worth in thousands of money-saving installations throughout the world. Normally hard-to-handle fluids—hot, volatile, toxic, corrosive, explosive, sensitive, radioactive—just can't leak or become contaminated. For capacities, heads, and other application information, send for new 16-page *Bulletin 1010.*

Engineering representatives in over 30 principal cities in the United States and Canada.



Sectional view of Model CHS *Chempump.* Heat exchanger in circulating line used for applications in the 450°—700°F range.

Chempump

CHEMPUMP CORP. • 1300 E. MERMAID LANE • PHILADELPHIA 18, PA.

Please send me details on use of *Chempump* for:

_____
(application)

*Capacity*_____ *Total dynamic head*_____

*Name*_____ *Title*_____

*Company*_____

*Address*_____

*City*_____ *Zone*_____ *State*_____

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MULTICOLOR APPEAL—More than 1,000,000 square feet of exterior and interior surfaces of the new Beverly Hilton Hotel in Beverly Hills, Calif. have been decorated with single-spray applications of multicolor lacquer. Based on Hercules® nitrocellulose, multicolor lacquers are gaining increasing acceptance as a fast-drying, economical, and durable decorative finish.

A PRODUCTION LINE PROBLEM, excessive foam can destroy quality control in the manufacture of paper, synthetic rubber, and other products. A 2½ pound brick of convenient, easy-to-handle Hercules® Defoamer 4, however, can make as much as 40 gallons of highly effective foam control solution. Send for free testing sample.

A NEW SOURCE OF SUPPLY for acetone has been created by Hercules' Gibbstown, N. J. oxychemical plant. From photographic film to nail polish, from paints and lacquers to acetate rayon, acetone plays a vital production role as a solvent.

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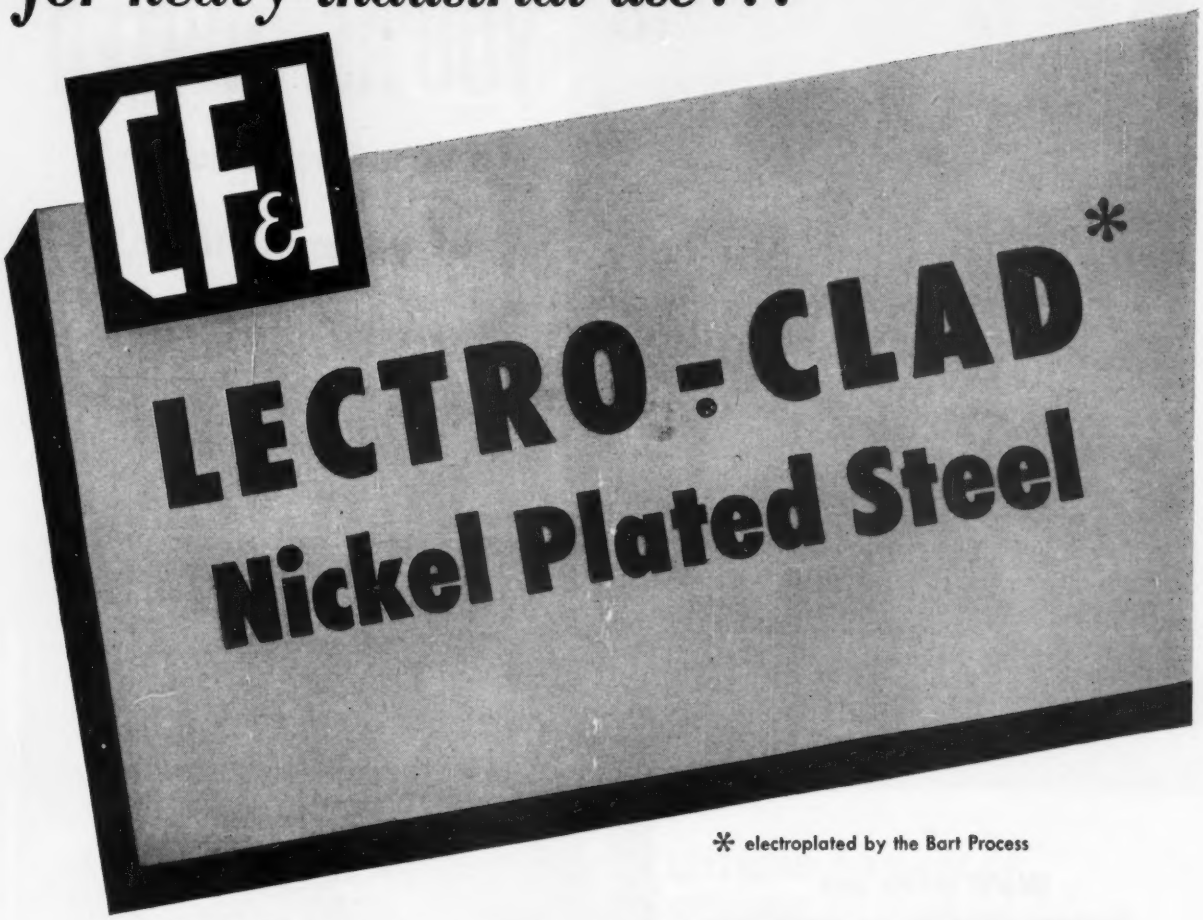
CHEMICAL MATERIALS FOR INDUSTRY

for heavy industrial use . . .



* electroplated by the Bart Process

provides economical protection against product contamination and discoloration

It is no longer necessary to spend large sums of money to get protection against product contamination and discoloration in heavy industrial applications. It's available *at a surprisingly low cost* when you use CF&I LECTRO-CLAD Nickel Plated Steel Plates, Sheets, Heads, Pipe and Fittings.

Proven during more than ten years of use by the Atomic Energy Commission and leading chemical processing firms, these products have all the strength of the carbon steel to which the plating is applied. In addition, they have a uniform, electro-deposited coating of pure nickel for maximum protection. The nickel will not check, spall or flake even when subject to the severest forming processes.

Perhaps you can use CF&I LECTRO-CLAD Nickel Plated Steel to advantage in your own operations. For complete details on applications and fabrication, write for our new LECTRO-CLAD Technical Manual—Wickwire Spencer Steel Division, The Colorado Fuel and Iron Corporation, P. O. Box 1951, Wilmington, Delaware.

3417

CF&I *Claymont Steel Products*

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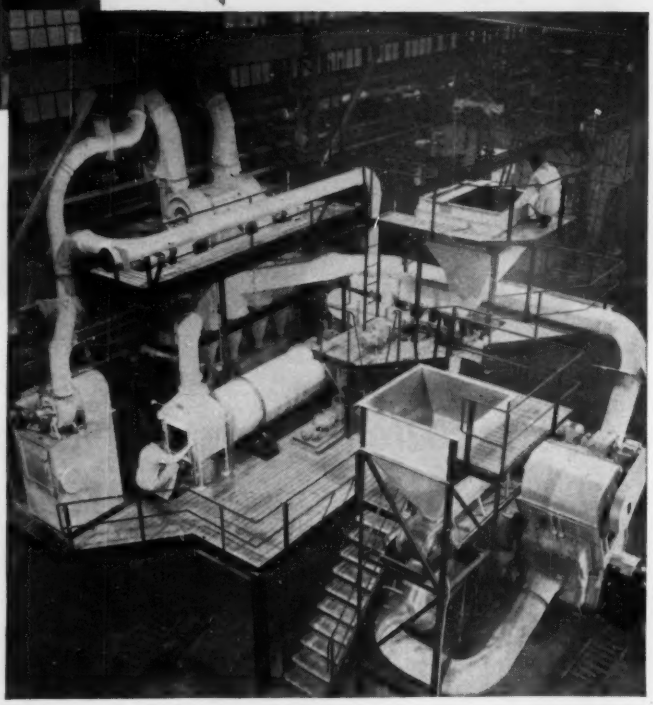
to send us a sample

of your material

. . . a pound

or a ton . . .



In fully-staffed, modern laboratory, miniature equipment is used to test small batches sent to Link-Belt.

Full-scale facilities are used for large runs. Over 1000 of these tests have been made, on more than 100 products.

•

We'll work out drying, cooling or roasting procedures for you

WHAT'S the best drying, cooling or roasting method for processing your materials? Hundreds of plants throughout the world have found an exact, detailed answer through Link-Belt test runs. Here's how it works:

- You send a representative sample of your product — a pound or a ton — with a complete description . . . covering initial moisture, critical temperatures and your merchandising objectives.
- On equipment like that shown above, our specialists conduct test-runs — find how to blend, compound or convert it to desired chemical composition. Our analytical laboratory will determine needed catalyst or agents to be added, if tests so indicate.
- With probable efficiencies decided, we'll lay out flow charts of methods you can follow in your own plant.

If shipping your product is impractical, we'll gladly set up a pilot unit on loan at your plant. Write or send samples to LINK-BELT COMPANY, 300 West Pershing Road, Chicago, Ill.

LINK-BELT

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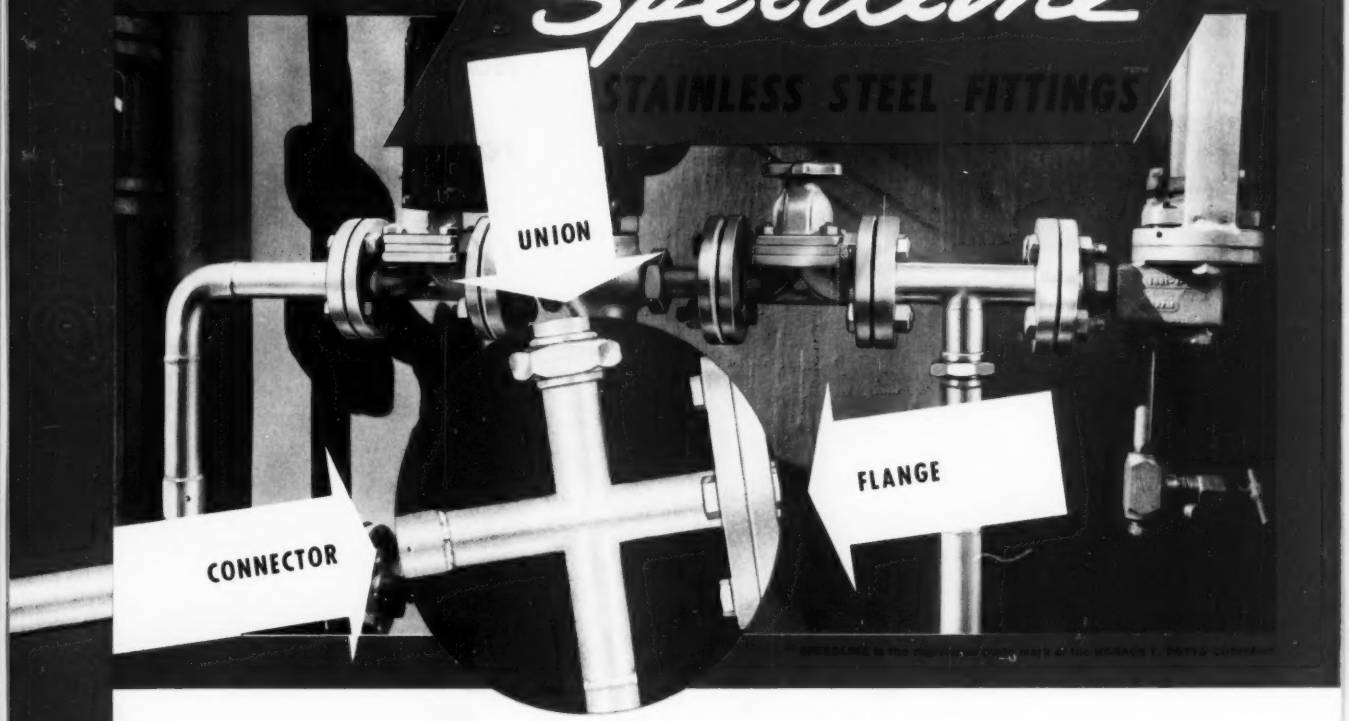
Now ...GREATER FLEXIBILITY AND ECONOMY WITH Speedline

STAINLESS STEEL FITTINGS



A NEW CONCEPT IN PROCESS PIPING

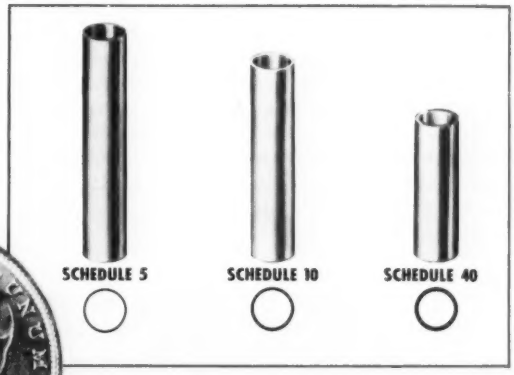
BUTT WELD

Each length of pipe shown at right costs one dollar! Why? *The thickness of the pipe wall!* Yet with Schedule 40 pipe and screwed fittings you lose ½ the wall you bought—*at the threads.* Lighter wall pipe meets pressure safety requirements for process piping (one inch size at 150 psi, Schedule 10—83 to 1 safety factor; Schedule 5—50 to 1 safety factor) . . . correct analysis effectively combats corrosion and contamination regardless of wall thickness!

Now . . . you can save up to 50% in materials costs . . . get 10 to 12% greater flow capacity . . . and SPEEDLINE Fittings are especially designed for low cost, light-wall Schedules 5 and 10 pipe.

EXCLUSIVE FEATURES OF SPEEDLINE FITTINGS offer economy and assembly advantages never before possible with conventional fittings—

- —Multiple choice of joint with *every* fitting!
- —Simplified design and assembly on the most complicated installations!
- —Use of low cost Schedules 5 and 10 stainless steel pipe!



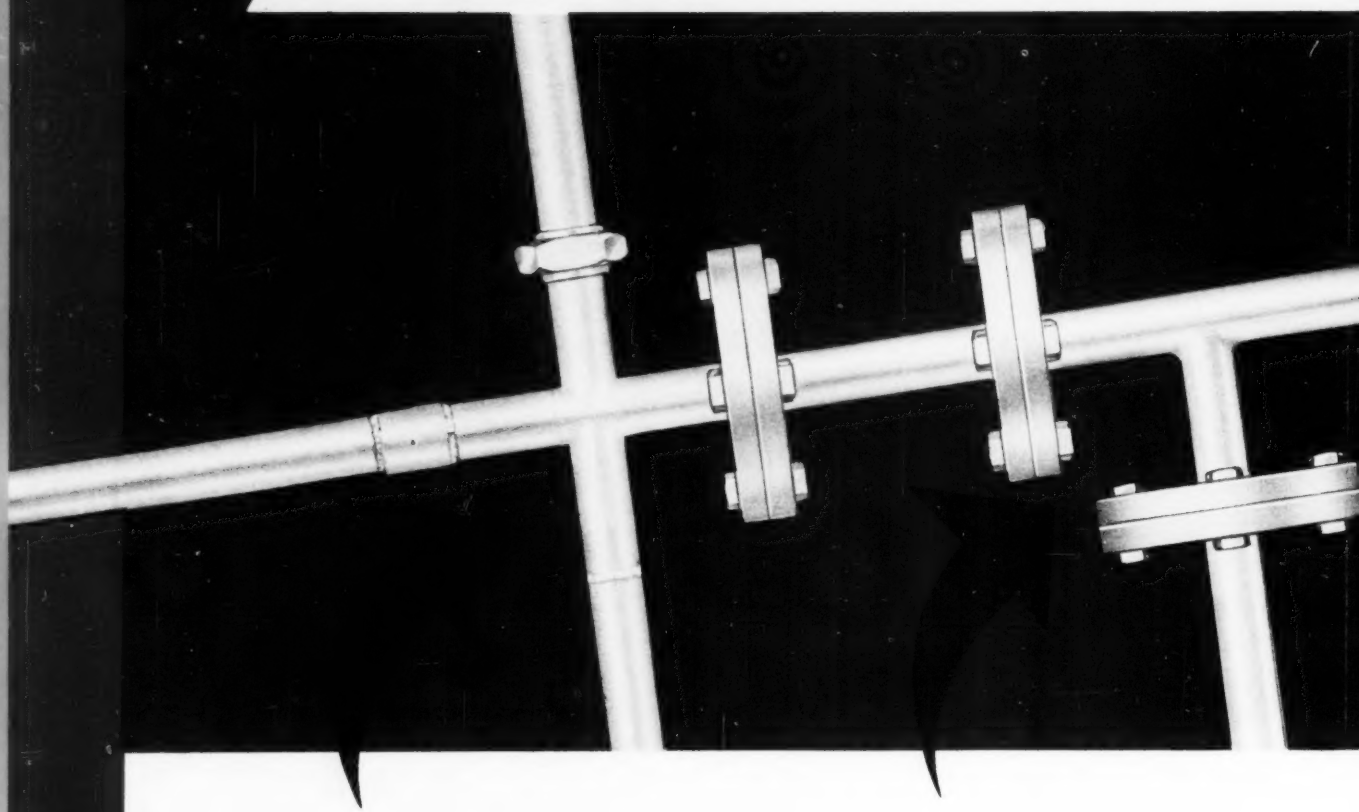
BUY ONLY THE PIPE WALL YOU NEED

. . . CUT COSTS WITH SPEEDLINE FITTINGS

VISIT BOOTH # 307 AT THE CHEMICAL SHOW TO LEARN MORE ABOUT SPEEDLINE FITTINGS

Speedline STAINLESS STEEL FITTINGS

CUT COSTS . . . SIMPLIFY PIPELINE DESIGN AND



FLEXIBILITY OF INSTALLATION

Flange where you want to . . . weld where you want to—any type of joint can be used with Speedline Fittings! To minimize design detailing the type of joint can be selected by the pipe crew—"on the job"! Butt welded joints, flanged joints, aligning connectors and unions can be used on *any*—or *all*—ends of *every* Speedline Fitting. This greater flexibility of installation with Speedline Fittings makes possible time and space saving process pipeline assemblies.

TANGENTIAL FEATURE

Conventional welding fittings often present assembly problems because of their minimum dimensions. Speedline's exclusive "tangential feature"—an *additional* straight section on every end of the fitting—eliminates these and other problems by permitting

- More Clearance for Welding
- Easier Aligning—with or without aligning connectors
- Flanging *without* Welding • Multiple Choice Assembly

The "tangential feature" is common to all Speedline formed fittings—Ells, Tees, Crosses, Reducers, and Return Bends.

Write for a copy of new, illustrated booklet, "Speedline Fittings" . . . without obligation.

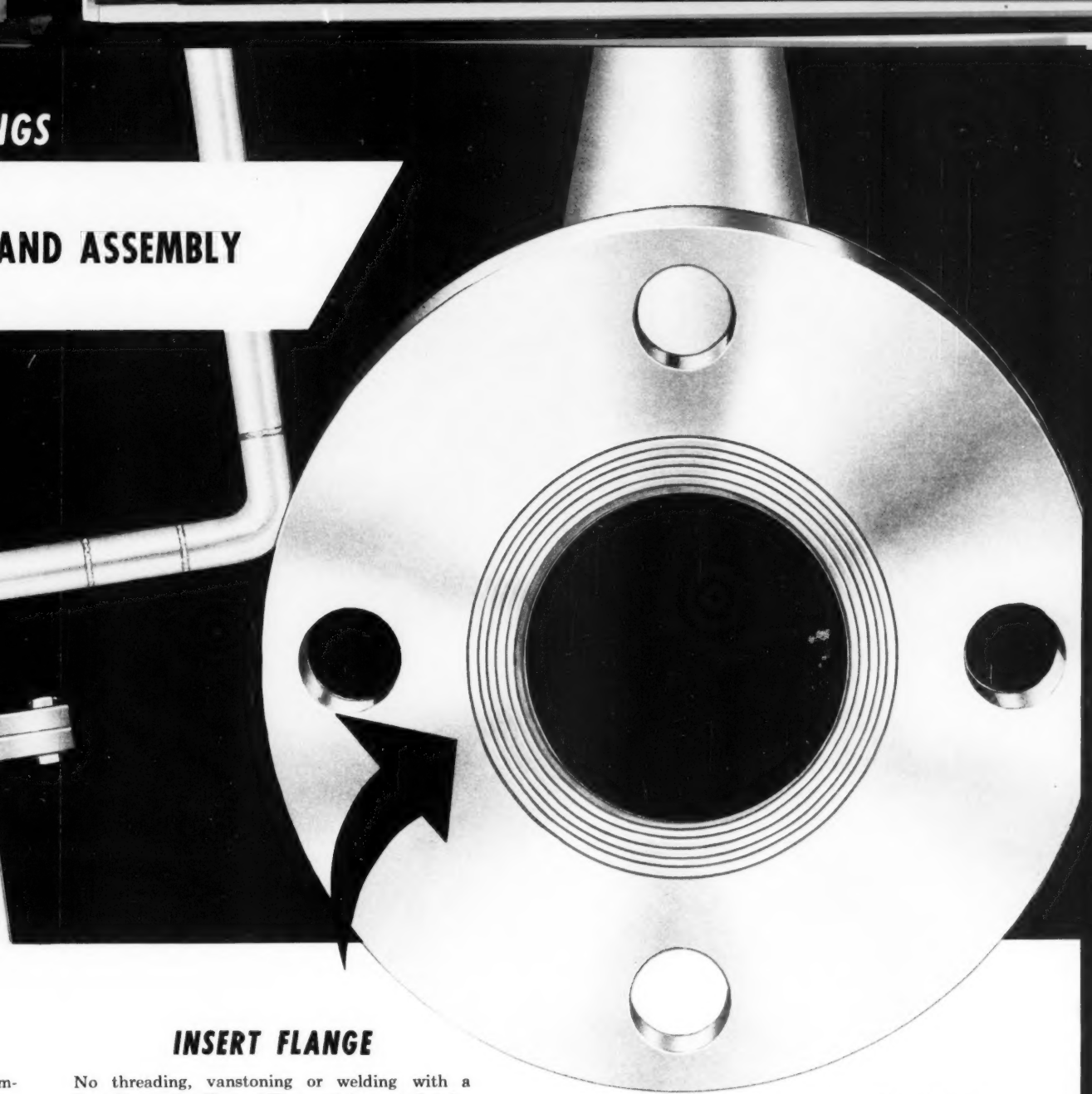
Speedline

A complete line o

SPEEDLINE Fittings are manufactured and distributed by HORACE T. POTTS COMPANY, serving industry for over 140 YEARS. 564 E. Erie Avenue, Phila. 34, Pa. SPEEDLINE Distributors are located in principal cities from coast to coast.

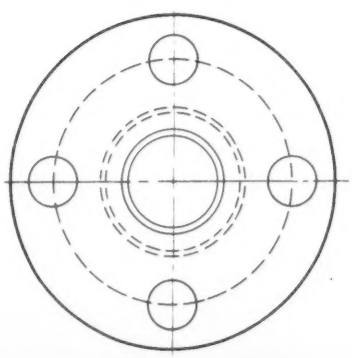
IGS

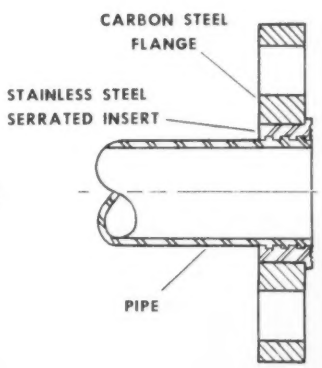
AND ASSEMBLY



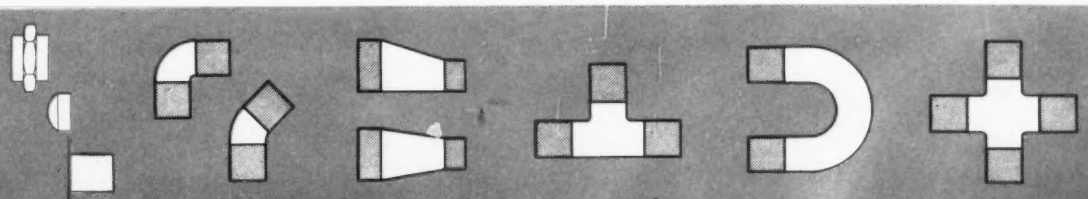
INSERT FLANGE

No threading, vanstoning or welding with a Speedline Insert Flange! The special serrated stainless steel insert—set in a carbon steel flange—is designed for easy expanding to obtain a tight, leakproof joint . . . in less time, at less cost and with less costly tools. No heat is required during expansion to damage the corrosion resistance of the metal . . . pipe cutting to exact length requires only an allowance for the thickness of the gasket. A plain wrench is the only tool needed for use with the Speedline Expander, specially designed to clear bends without fouling.





e line of fittings especially designed for Schedules 5 & 10 stainless steel pipe.



Shaded area indicates exclusive Tangential Feature.

LEADING PLANTS SET NEW STANDARDS IN PIPELINE ECONOMY

Speedline

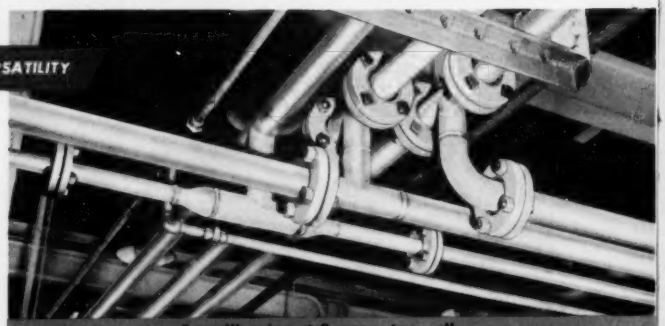
FITTINGS MAKE THE DIFFERENCE!

AN INDIANA FERTILIZER PLANT REPORTS:

Only 3.2% of Total Piping Costs go for Labor! Cost breakdown on a recently completed stainless steel piping installation at E. Rauh and Sons Fertilizer Company, Indianapolis, Indiana, revealed 96.8% of the total expenditure was for materials . . . only 3.2% for labor!

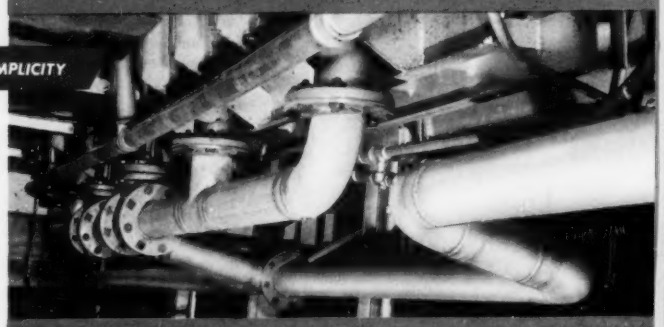
Materials costs represented exceptional savings, too, because Plant Engineer was able to use low cost Schedule 5 pipe with SPEEDLINE Fittings for the entire line . . . without loss of effective wall for pressure and flow requirements. The result? Almost 50% saving in material costs as compared to using Schedule 40 pipe with conventional fittings!

VERSATILITY



Speedline insert flanges, tees, ells and reducers with Schedule 5 pipe.

SIMPLICITY

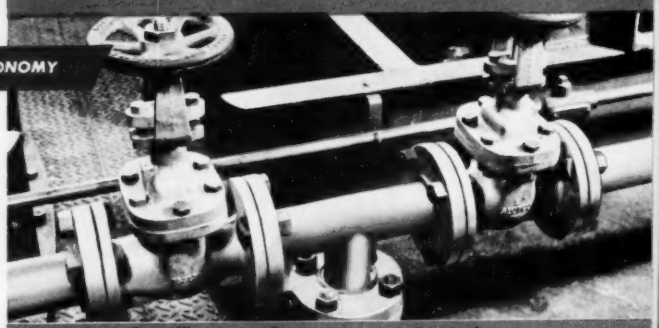


Aligning connectors simplify field erection.

A PENNSYLVANIA PROCESS PLANT REPORTS:

"Schedule 5 stainless steel pipe and SPEEDLINE Fittings were selected because of economy and because they were easier to install. Also SPEEDLINE Fittings assured a leak-proof joint."

ECONOMY

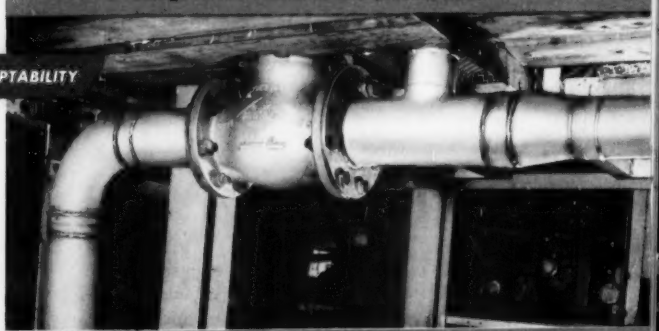


Speedline insert flanges, connect pipe and fittings to the valves in this process line.

A NEW JERSEY PLANT REPORTS:

"The use of SPEEDLINE Fittings practically eliminated turbulence in our lines, and the use of Schedule 5 pipe increased the flow over 10%."

ADAPTABILITY



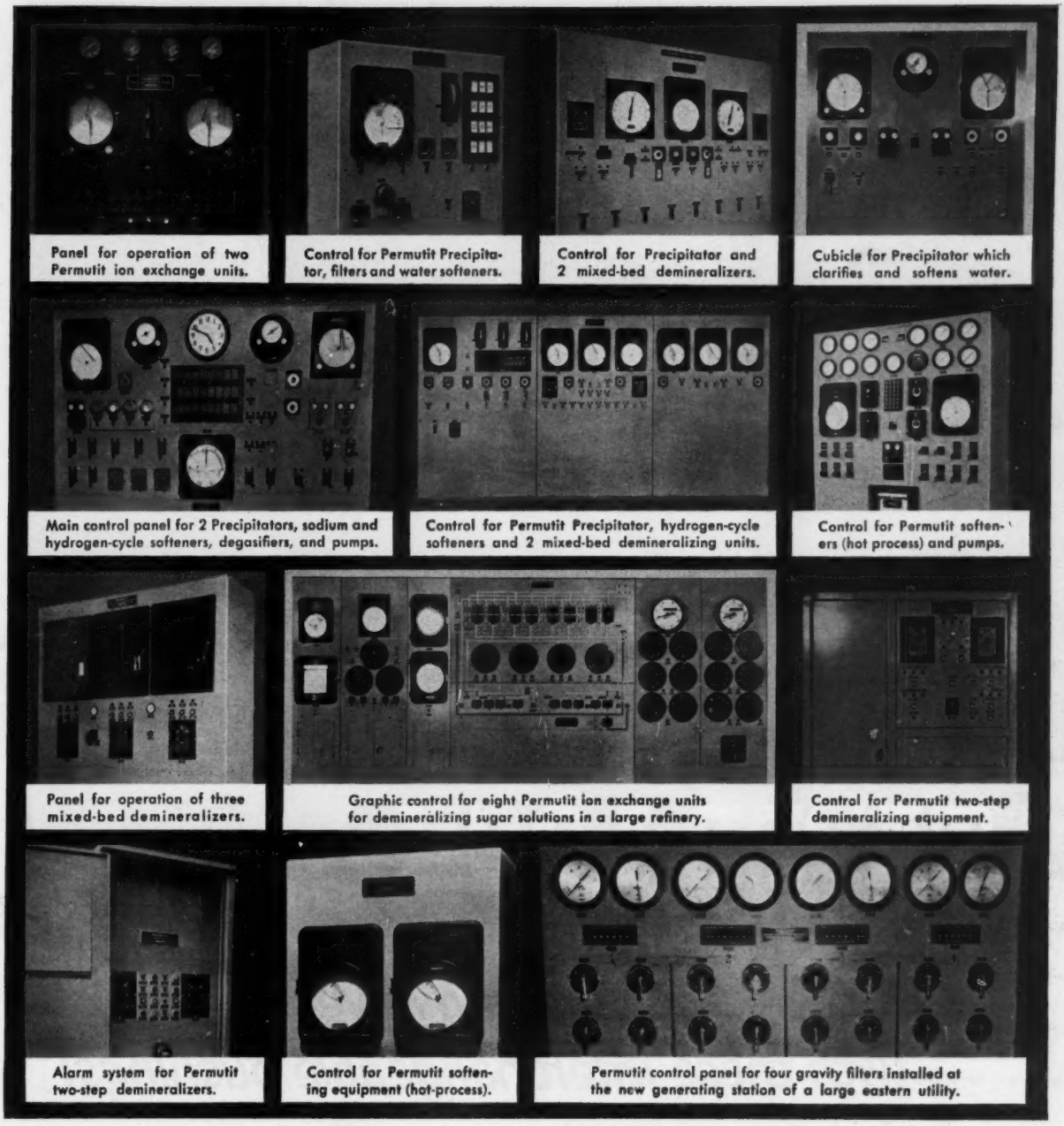
Tees, Reducers, 90° ells, aligning connectors on process lines.

AN EASTERN CHEMICAL PLANT REPORTS:

"SPEEDLINE Fittings were selected because they effected a 50% cost saving in materials and assembly."

Speedline

STAINLESS STEEL FITTINGS are manufactured and distributed by Horace T. Potts Company, 564 E. Erie Avenue, Phila. 34, Pa. SPEEDLINE Distributors are located in principal cities from coast to coast.



Panel for operation of two Permutit ion exchange units.

Control for Permutit Precipitator, filters and water softeners.

Control for Precipitator and 2 mixed-bed demineralizers.

Cubicle for Precipitator which clarifies and softens water.

Main control panel for 2 Precipitators, sodium and hydrogen-cycle softeners, degasifiers, and pumps.

Control for Permutit Precipitator, hydrogen-cycle softeners and 2 mixed-bed demineralizing units.

Control for Permutit softeners (hot process) and pumps.

Panel for operation of three mixed-bed demineralizers.

Graphic control for eight Permutit ion exchange units for demineralizing sugar solutions in a large refinery.

Control for Permutit two-step demineralizing equipment.

Alarm system for Permutit two-step demineralizers.

Control for Permutit softening equipment (hot-process).

Permutit control panel for four gravity filters installed at the new generating station of a large eastern utility.

Why we make our own panels:

Life might be simpler if we "farmed out" our control cubicles and instrument panels . . . but we like to build *every* major component of a PERMUTIT water-conditioning or ion exchange system . . . so that we know it will do its specific job properly.

That's why these panels . . . and the hundreds of others in power plants, chemical process plants, manufacturing plants and municipal water works . . . are designed by Permutit engineers and assembled, wired and piped in Permutit factories.

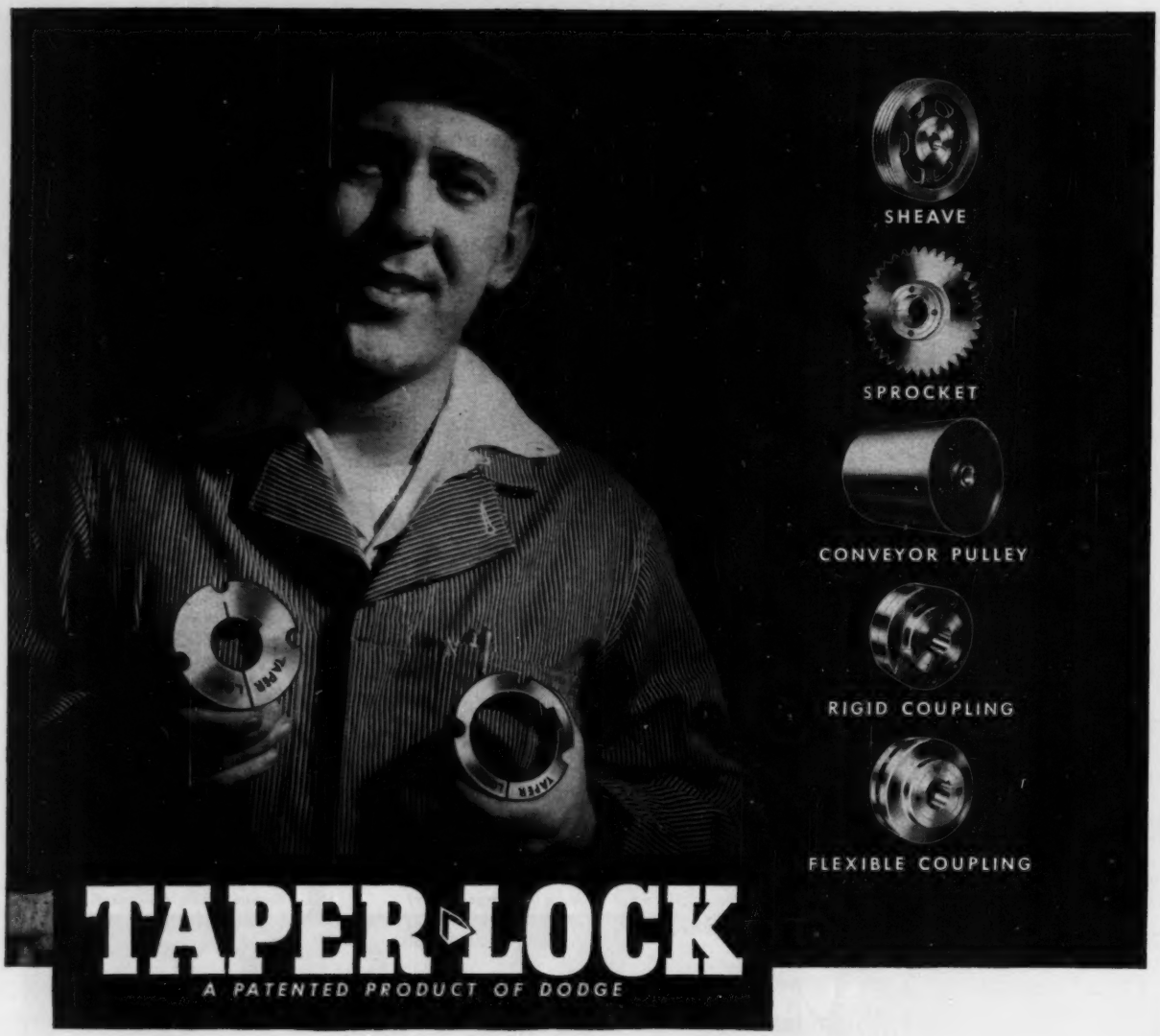
That's why we design and build our own special parts such as multiport valves, strainer systems and chemical feeders. That's why we make our own ion exchange resins.

As a result, we talk in terms of over-all results. And you get *complete* service from *one* source.

For further information, write to: The Permutit Company, Dept. CE-11, 330 West 42nd St., New York 36, New York.

WATER CONDITIONING • ION EXCHANGE

PERMUTIT®



TAPER-LOCK

A PATENTED PRODUCT OF DODGE

"Brother...you sure can save with these interchangeable bushings!"

With a few Taper-Lock bushings you can make quicker changes and cut down-time on production machines—because Taper-Lock bushings are *interchangeable*. Shift from a Dodge sprocket to a Dodge sheave, and use the same bushing! Taper-Lock bushings are available in a range of sizes which makes changing from one size shaft to another equally easy and quick.

Mount 'em all with Taper-Lock bushings—your sheaves, sprockets, couplings, conveyor pulleys. They slip on the shaft quickly—hold with the firmness of a shrunk-on fit—come off easily without shock to bearings or machinery. Standardize, economize with Taper-Lock.

DODGE MANUFACTURING CORPORATION, 200 Union St., Mishawaka, Ind.

THERE'S ONLY ONE TAPER-LOCK, THE BUSHING THAT MOUNTS FLUSH!

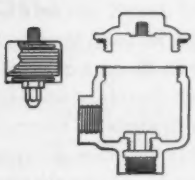
CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory trained by Dodge, he can give you valuable assistance on new, cost-saving methods. Look for his name under "Power Transmission Machinery" in your classified telephone directory, or write us.

DODGE

of Mishawaka, Ind.

Quality

Just 3 quality parts—thermostatic bellows, body, cap. Simple, positive action. Won't leak!



Nicholson quality . . . that gives you the extra strength, extra capacity, extra *stamina* required for severest chemical processing service. Nicholson quality pays off, when it comes to discharging condensate and air from steam lines . . . most efficiently, dependably, economically.

- **Powerful valve action—big husky bellows.**
- **Positive shut-off—finely ground valve and seat.**
- **High capacity—large diameter orifice.**
- **Rigidly tested—on actual steam lines.**

When less than best won't do, specify Nicholson. Send for *Catalog 953*.

NICHOLSON

W. H. NICHOLSON and Company

TRAPS • VALVES • FLOATS • METAL PARTITIONS

14 OREGON STREET, WILKES-BARRE, PA. • SALES AND ENGINEERING OFFICES IN 58 PRINCIPAL CITIES

Is your waste line getting too expensive?

You may be able to reduce it with corrosion-resistant Republic SRK

Here's your opportunity to cut periodic and costly pipe replacement. It's a new, rugged plastic pipe—Republic's Semi-Rigid Kralastic. Equally useful in both waste and process lines, it is highly resistant to an impressive list of corrosive liquids and gases (see chart).

Within its temperature and pressure limitations, Republic Semi-Rigid Kralastic should prove ideal for many applications in the food processing and chemical industries. Extremely tough, it will absorb punishment without breaking or shattering. Here are more advantages:

Lightweight . . . It's easy to handle, transport and install. Three 20-foot lengths of 4″ Kralastic can be carried by one man.

Easy to Cut . . . Only tool needed is an ordinary handsaw or hacksaw. Pipe can be cut while being held across knee.

Easy to Join . . . Takes only a minute or two. Simply brush on special solvent. A wide variety of plastic fittings is available.

Low Friction Loss . . . Smooth interior surface permits high rate of flow, reduces friction loss, minimizes clogging.

Non-Toxic . . . It's made from virgin materials. This permits transmission of fluids for human or animal consumption.

Immune to Sunlight . . . Carbon-black additive provides protection from ultraviolet rays.

Combines with Steel . . . Special fittings permit easy connection with steel pipe.

Modern techniques and highest standards of quality control result in wall sections of uniform strength throughout each length. Republic Semi-Rigid Kralastic comes in three working pressures—with specific sizes for each (straight lengths only). Pipe of 150 lb. rating comes in sizes ½″ through 2″; pipe of 100 lb. rating is available in sizes 2″ through 6″; 75 lb. rated pipe is made in 3″, 4″ and 6″ sizes. Republic Steel also supplies Semi-Rigid Butyrate and Flexible Polyethylene. If you have a problem, write us. We will recommend the proper material for your job. Send coupon for literature.

REPUBLIC STEEL CORPORATION
3116 East 45th Street
Cleveland 27, Ohio

REPUBLIC STEEL

Please send more information on:

☐ Republic Semi-Rigid Kralastic ☐ ENDURO® Stainless Steel

☐ Dekoron®-Coated E.M.T. ☐ Steel Barrels and Drums

Name_____ Title_____

Company_____

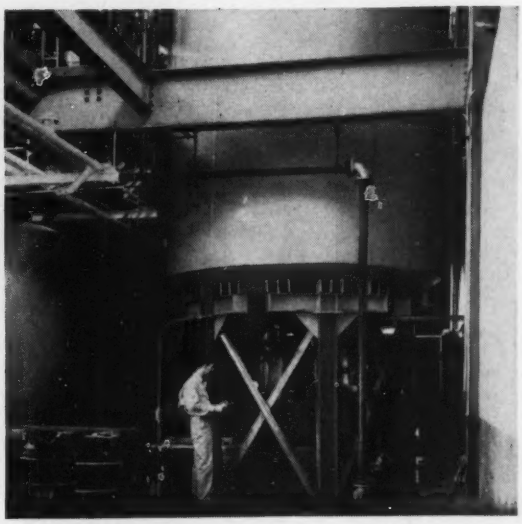
Address_____

City_____ Zone____ State_____

K-8781

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products



FREEDOM FROM CORROSION makes ENDURO Stainless Steel Equipment your best buy. Equipment made from ENDURO, like this penicillin fermentation tank, stays on the job, requires minimum maintenance, lasts long. ENDURO protects purity and chemistry from contamination and side reactions. It's easy to keep clean and attractive. Republic will help you and your equipment suppliers apply ENDURO's qualities and benefits efficiently and economically.

CHEMICAL RESISTANCE CHART RATINGS

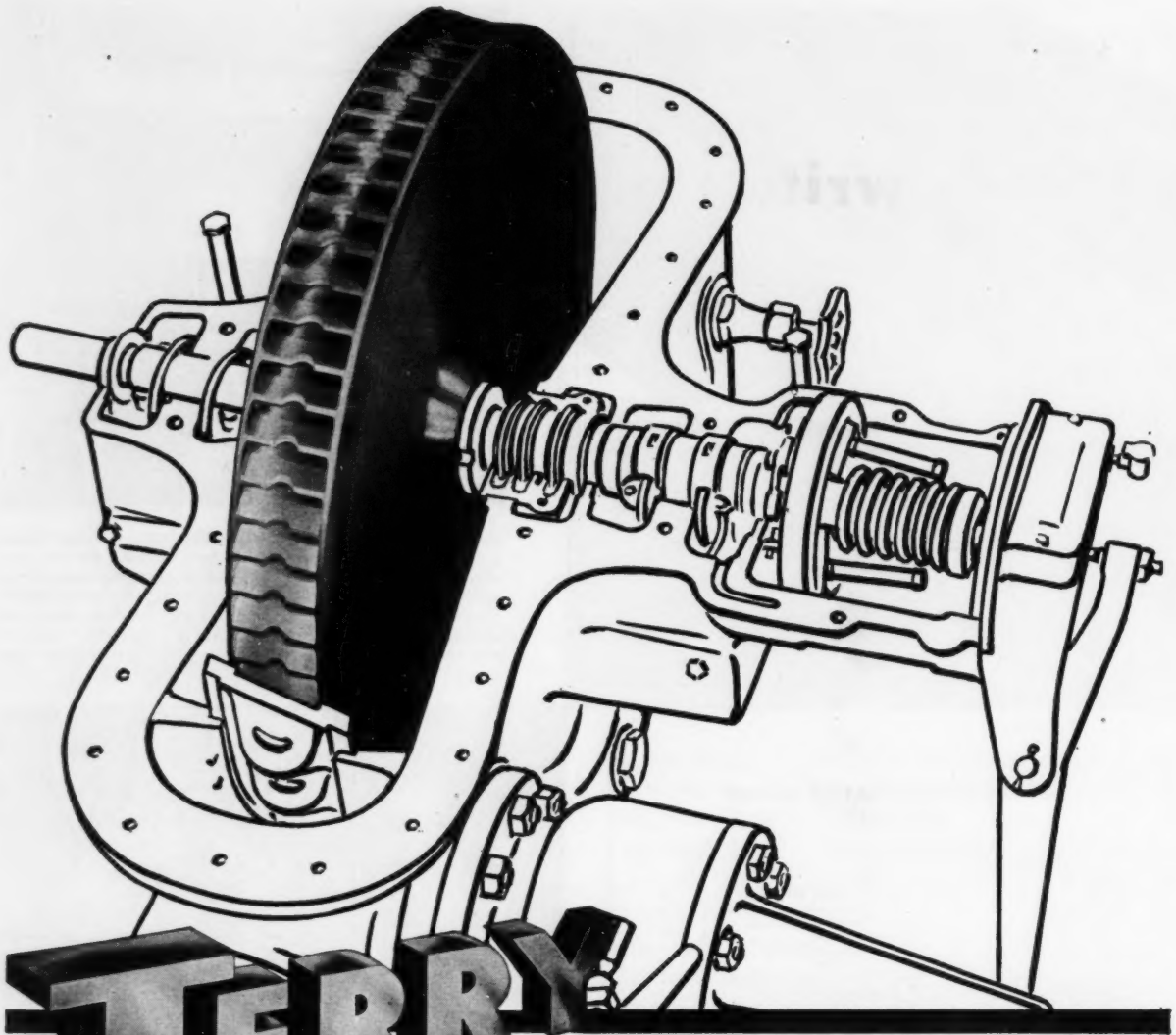
E—No attack. G—Appreciably no attack. N—Badly attacked.
F—Some attack but usable in some instances. C—Cold—77°F.
P—Attacked—not recommended. H—Hot—170°F.

	C	H
ACIDS		
Acetic, 10%	E	E
Acetic, glacial	N	N
Benzene sulfonic	E	E
Benzoic	E	E
Boric	E	E
Butyric	N	N
Chloroacetic	N	N
Chromic, 10%	E	N
Chromic, 50%	F	N
Citric	E	E
Fatty Acids	E	E
Fluosilicic	E	E
Formic, 90%	N	N
Hydrobromic	E	F
Hydrochloric	E	F
Hydrocyanic	E	E
Hydrofluoric	E	F
Hypochlorous	E	F
Lactic	E	F
Maleic	E	E
Nitric, 5%	G	N
Nitric, 20%	F	N
Nitric, 40%	N	N
Oleic	E	E
Oxalic	E	E
Perchloric	E	F
Phosphoric	E	F
Picric	E	E
Stearic	E	E
Sulfuric, 50%	E	E
Sulfuric, 70%	G	N
Sulfuric, 93%	N	N
Oleum	N	N
Mixed Acids 57% H_2SO_4 28% HNO_3	N	N
ALKALIES		
Ammonium hydroxide	E	E
Calcium hydroxide	E	E
Potassium hydroxide	E	E
Sodium hydroxide	E	E
ACID SALTS		
Alum or Aluminum sulfate	E	E
Ammonium chloride, nitrate, sulfate	E	E
Copper chloride, nitrate, sulfate	E	E
Ferric chloride, nitrate, sulfate	E	E
Nickel chloride, nitrate, sulfate	E	E
Stannic chloride	E	E
Zinc chloride, sulfate	E	E
NEUTRAL SALTS		
Calcium chloride, sulfate	E	E
Magnesium chloride, sulfate	E	E
Potassium chloride, sulfate	E	E
Sodium chloride, sulfate	E	E
GASES		
Chlorine, wet	E	N
Chlorine, dry	E	F
Sulfur dioxide, wet	E	E
Sulfur dioxide, dry	E	E
ORGANIC MATERIALS		
Acetone	N	N
Alcohols, methyl, ethyl	E	P
Aniline	N	N
Benzene	N	N
Carbon tetrachloride	N	N
Chloroform	N	N
Ethyl Acetate	N	N
Ethylene dichloride	N	N
Formaldehyde, 37%	E	E
Phenol, 5%	G	F
Refinery crudes	E	E
Trichloroethylene	N	N
PAPER MILL APPLICATIONS		
Kraft liquor	E	F
Black liquor	E	F
Green liquor	E	F
White liquor	E	F
Sulfite liquor	E	F
Chlorite bleach	E	P
Alum	E	E
PHOTOGRAPHIC INDUSTRY		
Developers	E	E
General use	E	E
Silver nitrate	E	E
FERTILIZER INDUSTRY		
General use	E	F
STEEL INDUSTRY		
Sulfuric acid pickling	E	E
Hydrochloric acid pickling	E	E
H_2SO_4, HNO_3 pickling	N	N
TEXTILE INDUSTRY		
General use	E	E
FOOD INDUSTRY		
General use	E	E
Breweries	E	E
Dairies	E	E

NOTE: This chart is offered as a guide only and is based on tests which we believe to be reliable. However, it is suggested that the user check SRK for chemical resistance in the application for which it is intended.

IN VERY SEVERE CORROSIVE CONDITIONS Republic Dekoron-Coated E.M.T. protects electrical raceways. Its tough, polyethylene coating over the galvanized finish gives double protection. Moisture-tight joints are easily made, using threadless connectors and couplings. Joints are sealed with tape. Dekoron-Coated E.M.T. provides an economical, maintenance-free raceway that resists corrosion and reduces costs.

NO CONTAMINATION—NO SPOILAGE. Republic Steel offers a full range of barrels, drums and pails in a variety of metals and finishes to protect your products. Choose from ENDURO Stainless Steel, hot dipped galvanized steel, hot dipped tinned steel, mill galvanized sheet steel, hot rolled open hearth steel, plain or lacquer lined. Choice of gages to meet all handling and shipping requirements. Many styles in sizes up to 55 gallons.



SOLID WHEEL RUGGEDNESS

is your turbine dividend

The rugged construction and fool-proof design of a Terry solid-wheel turbine can save you money by keeping maintenance costs to a minimum. Usually only taken down for routine inspection, any repairs that must be made are of relatively simple nature, and cost of replacement parts is small.

The rotor of the turbine is a single forging of special composition steel, in which a series of semi-circular buckets is milled. There are no separate parts to loosen or work out. As the only function of the blades is to form a series of pockets, any wear which might occur would not materially affect horsepower or efficiency.

It is impossible for the blades to foul. They have large clearances and are further protected by the projecting rims of the sides of the wheel. As the side clearances are also very large, end play can do no harm.

The Terry solid-wheel turbine is an extremely reliable piece of equipment—why not write for complete details today? Ask for a copy of Bulletin S-116.

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD 1, CONN.

TT-1198

write for your free copy

This 24-page booklet alphabetically lists the many chemicals available from Harshaw. Read the story about Harshaw's growth since its beginning in 1897. Pictures of plants, warehouses, research and manufacturing operations are scattered throughout the book. We will gladly send you a copy if you write.

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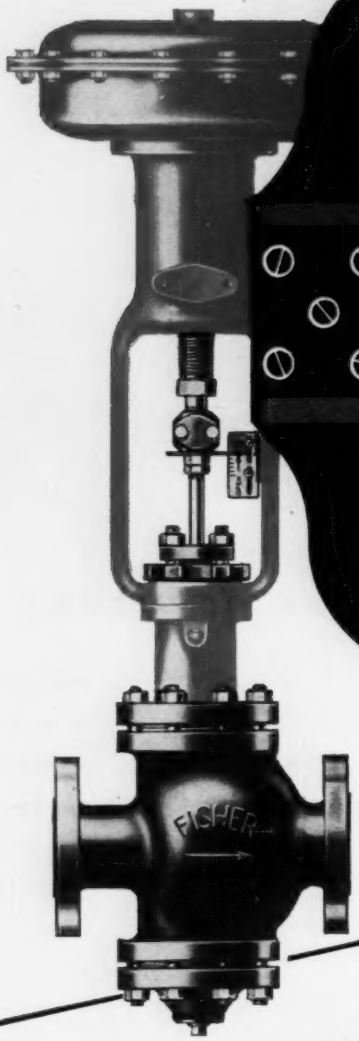
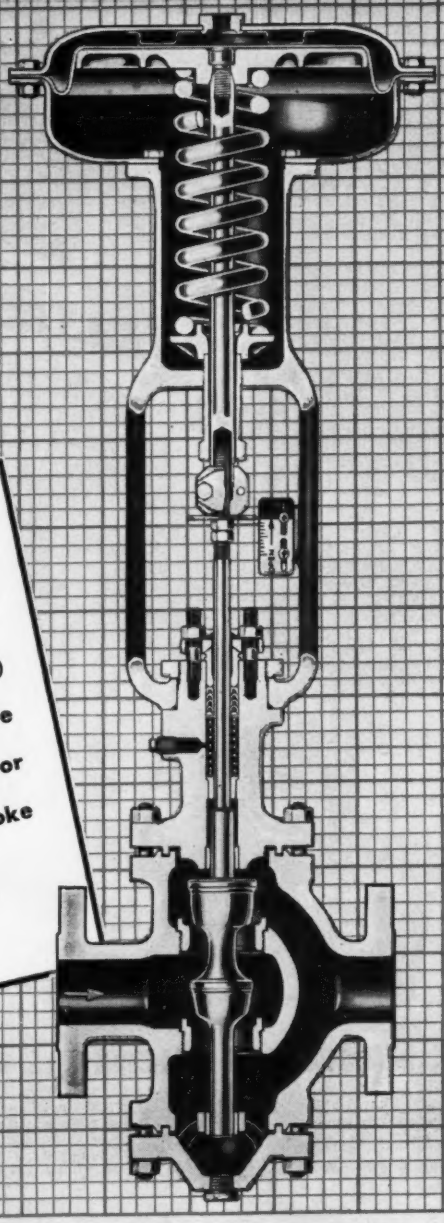
DIAPHRAGM





● **Fisher Diaphragm Motor Valves are furnished in a wide variety of pressure ratings and materials. Topworks may be either direct acting (Series 657) or reverse acting (Series 667). Handjacks are available for either diaphragm casing mounting or yoke mounting. There are six diaphragm and yoke size combinations.**

Improved

MOTOR VALVES

Improved PERFORMANCE FEATURES

- Bolted-clamp type stem connection allows stem adjustment of 50% of total travel. Can be disconnected in the field without stem damage. Will not shake loose from vibration or rotational inner valve forces.

- Rugged body to yoke connection with hammer lug nut. Topwork can be removed without disturbing stuffing box.

- Specially designed Buna N molded diaphragms with Nylon insert retain superior flexibility at low ambient operating temperatures. Provides linearity between operating pressure signal and travel, and gives maximum effective area.

- Bolted gland stuffing box with Teflon packing.

- Stainless steel clear view travel indicator.

- Spring ranges: 3 to 15 psi; 6 to 30 psi.

FISHER GOVERNOR COMPANY • Marshalltown, Iowa

WORLD LEADER IN RESEARCH FOR BETTER PRESSURE AND LIQUID LEVEL CONTROL

FISHER
Our 75th
ANNIVERSARY

Fiberglas sets world's "elbow-bending" record!

THIS COMPLETE ELBOW COVERING FABRICATED IN ONLY 29 SECONDS!

Simple pie cuts with an ordinary knife produce perfectly fitting segments. No hacking . . . no sawing!

Yes, for speedy handling and fabrication on the job—not only elbows but straightaway runs and odd-shaped equipment, fittings and ducts—Fiberglas* Insulations recognize no equal! Such performance is possible because Fiberglas is light, rigid, non-crumbling, so easy to cut. What a time-and-labor saver! Moreover, it's moisture-resistant and dimensionally stable . . . combines sound absorption with thermal efficiency. Want to test its workability for yourself? Just write, Owens-Corning Fiberglas Corporation, Dept. 97-J, Toledo 1, Ohio.

Fiberglas PF Panels for equipment and ducts possess the same workability as the Pipe Covering illustrated at top of page.

For High Temperatures—KAYLO®, King of High Temperature Insulations. A faultless performer up to 1200° F. Distributed by Owens-Corning Fiberglas Corporation.

Technical data will be found in Sweet's File, Chemical Engineering Catalog and Refinery Catalog.

OWENS-CORNING
FIBERGLAS

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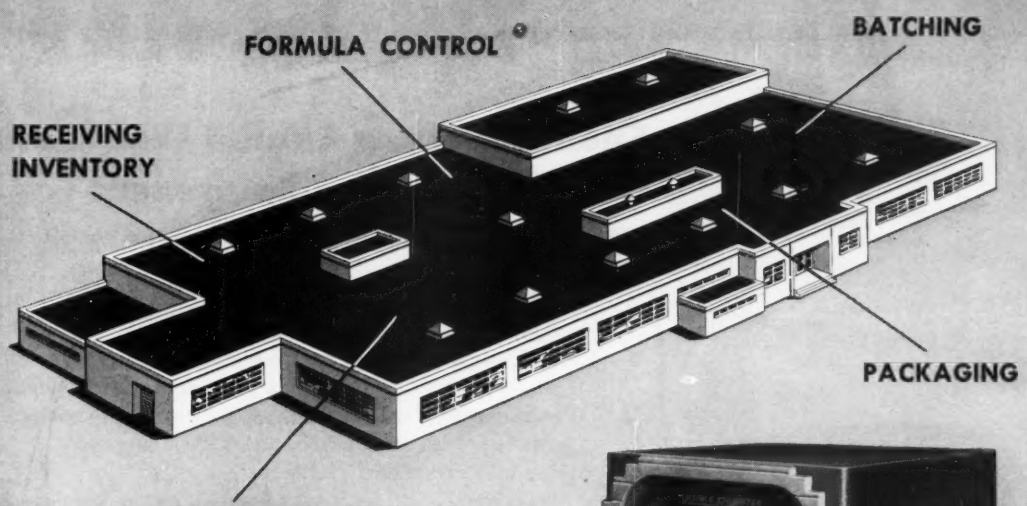
®Kaylo is mfd. by Kaylo Div., Owens-Illinois Glass Co., Inc.

Accounting at Every Liquid Handling Point



ROCKWELL ROTOCYCLE METER
Cutaway to show the all-revolving rotor construction

Rockwell Industrial Meters

Guard Your Liquids as You Guard Your Cash

Put Rockwell Industrial Meters to work. Then you'll control your costs . . . control your processes . . . control your end product quality. Rockwell meters are basic accounting tools for verifying purchases, for stopping losses, for inventory and departmental control and for tax analysis purposes. They will accurately measure most any liquid that can be piped. Available in all sizes and several types for every requirement. For full details use coupon or write.

"316" Stainless Steel Meter

FOR CORROSIVE LIQUIDS

This meter, made entirely of type 316 stainless steel is the answer to many a measurement problem in the Food, Chemical, Drug and Industrial Processing fields. It resists corrosion. Made in two sizes rated at 100 and 200 gpm. Quantity control valves, strainers and a variety of registers available. Described in bulletin OG-406.

YOU CAN RELY ON ROCKWELL

CLIP COUPON—MAIL TODAY

ROCKWELL MANUFACTURING COMPANY **Dept. 104-L**
Pittsburgh 8, Pennsylvania

Gentlemen:

I am interested in measuring _____
(Name of Liquid)

Pipe Size _____"

Working Pressure _____psi Temperature _____°F max.

Max. Flow Rate _____gpm Min. Flow Rate _____gpm

YOUR NAME _____

COMPANY _____

STREET _____

CITY _____ ZONE _____ STATE _____

This is AAF's

Chemical Show Exhibit Will Feature Complete Line of Equipment For Cleaning Air—Controlling Dust

New ideas and new products—you'll find them both at AAF's Chemical Show exhibit in December. You'll find tangible evidence of AAF engineers' awareness of your industry's ever-changing clean air and dust control requirements. You'll find a thought-provoking exhibit manned by sales engineers who talk your language and understand your problems.

Make it a point to visit AAF Booths 150-250. We guarantee you'll find it interesting—and profitable.

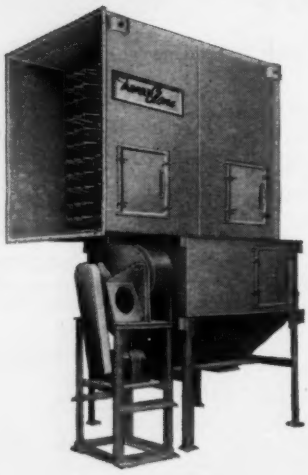
P. S. If you can't get to Philadelphia, your local AAF representative will gladly bring the show to you in the form of product bulletins and application data. Just say the word!

FOR COLLECTING PROCESS DUST

AMERclone

Dry Centrifugal Collector

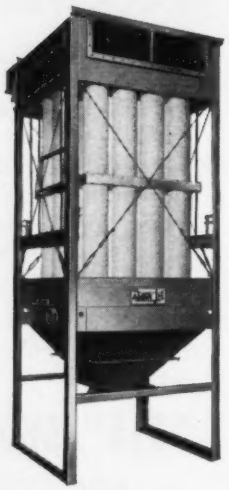
Designed to handle large exhaust volumes containing dry, granular dust in large concentrations. Features unique AMERclone tube of 4" diameter which has an approach velocity of 1000 fpm and a cleaning capacity of 350 cfm. Bulletin No. 291.



AMERjet

Fabric Dust Arrester

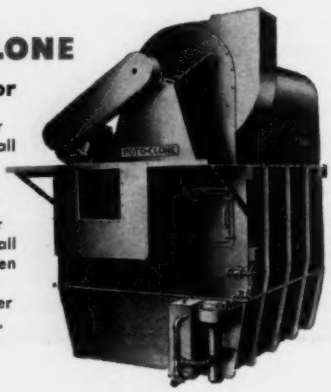
Recommended for handling extremely fine dust or dust that must be reclaimed dry. Continuous reconditioning of cleaning tubes by reverse jets of high pressure air permits five times greater velocities through the cleaning media than ordinary fabric collectors. Bulletin No. 279.



Type N ROTO-CLONE

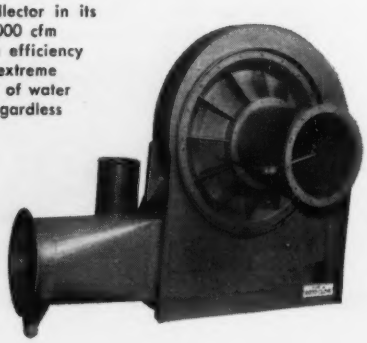
Hydro-static Precipitator

A wet-type collector designed for handling heavy duty loadings of all sizes. High cleaning efficiency results from combined action of centrifugal force and thorough
A wet-type collector designed for handling heavy duty loadings of all intermixing of water and dust-laden air. Unit requires no pumps or nozzles; maintains efficiency over wide range of exhaust volumes. Bulletin No. 277.



Type W ROTO-CLONE

Lowest priced wet dust collector in its class (units of 1500 to 50,000 cfm capacity designed for high efficiency dust collection, including extreme fines). Unit uses a minimum of water and maintains efficiency regardless of variations in air volume. Bulletin No. 274.



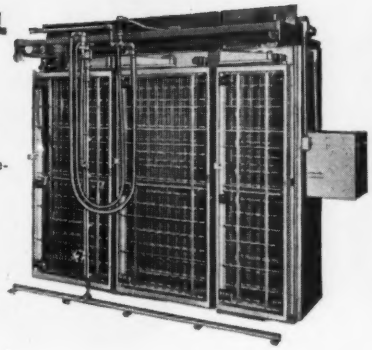
"Philadelphia Story"

FOR CLEANING PROCESS AIR

Electro-CELL

with Type H Washer

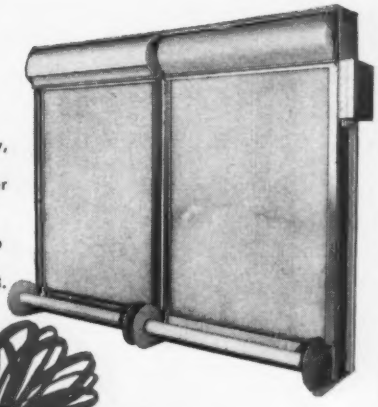
Reduces maintenance to the mere press of a button! A stationary-plate-type electronic precipitator which, with the addition of the Type H Washer, provides for washing of collector plates by a set of traveling spray nozzles. Bulletin No. 252.



ROLL-O-MATIC

Renewable Media Air Filter

Now, clean air by the roll. New, self-servicing ROLL-O-MATIC features renewable media filter curtain of bonded glass fibers in roll form. As clean media is introduced automatically at top of filter, soiled material is re-rolled at bottom. Bulletin No. 248.



Multi-PAK

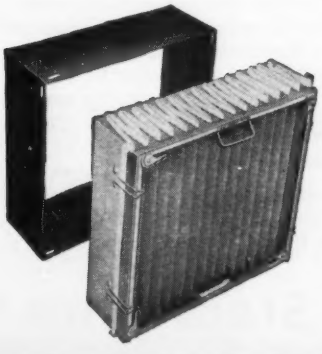
Deep Bed Air Filter

Making its initial "bow" at the Chemical Show. A deep bed type dry filter featuring ultra-high collection efficiencies, compact design and ease of maintenance. Unit utilizes wide range of media; is available in many metals and alloys. Bulletin No. 237.

Type PL-24

Air Filter

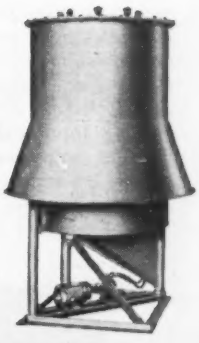
High efficiency at low cost! A dry-type filter offering highest cleaning efficiency of any commercial unit filter. Low cost Airmat paper media is quickly replaced when soiled, restoring filter to original efficiency. Bulletin No. 230.



Type P CYCOIL

Oil Bath Air Cleaner

A new high efficiency engine intake air cleaner that meets the lower allowable intake resistance demanded with the use of turbo-chargers and pressure blowers for scavenging. Bulletin No. 160.



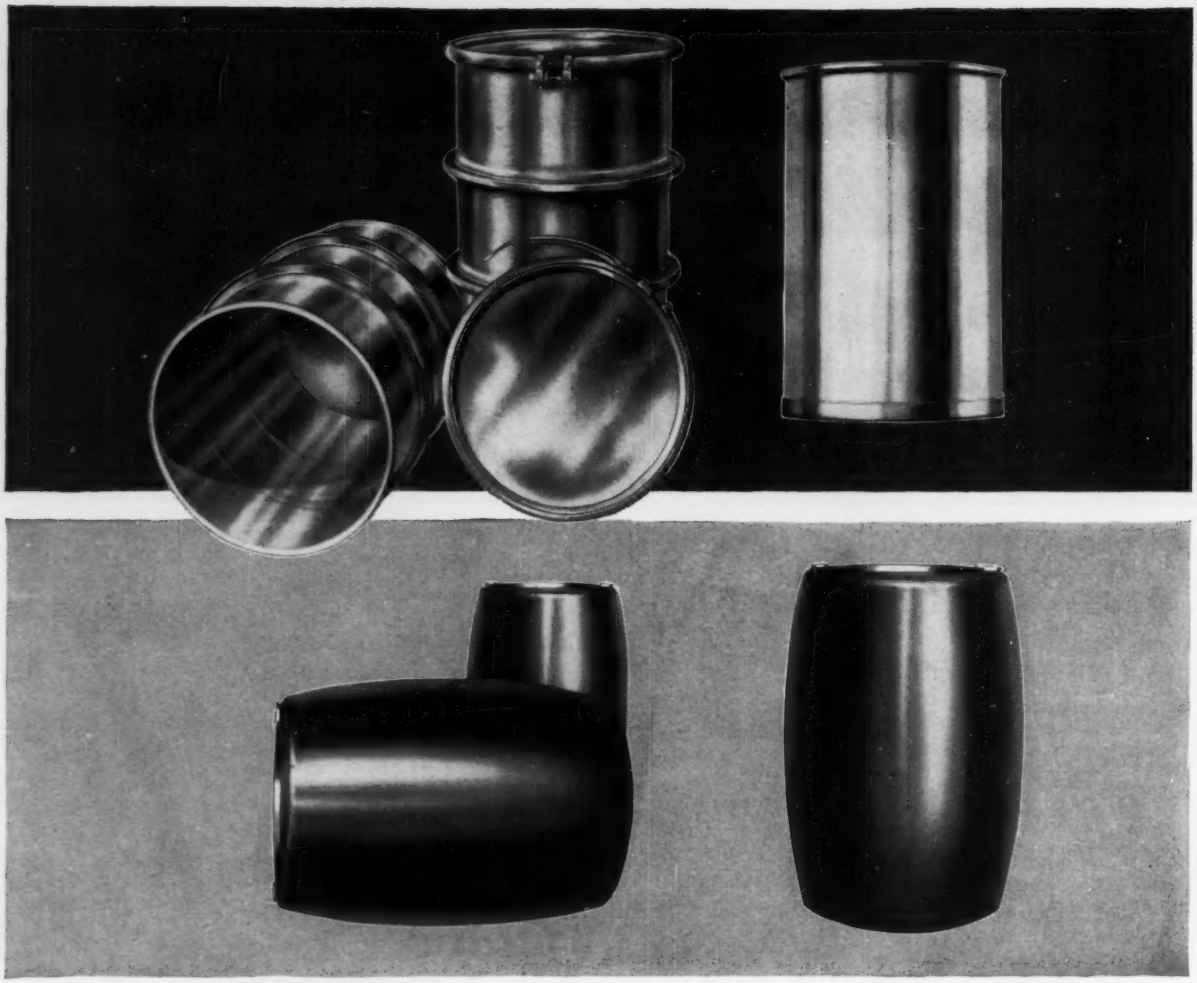
AAF

herman nelson

American Air Filter

COMPANY, INC.

American Air Filter of Canada, Ltd., Montreal, P. Q. • 326 Central Avenue, Louisville 8, Kentucky



Tiptop product protection with Hackney drums and barrels

Strong acids—delicate chemicals—perishable foods—flammable petroleum products—tacky printer's ink—whatever your problem product—it can be shipped safely and securely in one of the many Hackney returnable containers. Constant research into the problems of transporting and storing liquids and solids such as these is your assurance that you can always get the best possible container for your purpose from Pressed Steel Tank Company. Our more than 50 years' experience in developing and producing rugged, heavy-duty Hackney drums and barrels has resulted in a complete line of returnable containers that are durable, readily cleaned, easily handled, low-cost shippers.

Hackney returnable containers for every need—

Tight head or removable head types. Straight or bilged walls. Entirely seamless barrels formed from a single sheet of metal. Two-piece drums with a single, strong, circumferential weld. Three-piece drums with seamless chime and crevice-free interiors. Materials available to suit the requirements of your product—including steel, stainless steel, nickel, nickel alloy, aluminum. Various capacities, up to 55 gallons, or 110 gallons for some models.

The Hackney drum and barrel catalog is full of details. Send for your copy today.

Hackney MILWAUKEE — DOWNINGTOWN IRON WORKS

Pressed Steel Tank Company

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CONTAINERS AND PRESSURE VESSELS FOR GASES, LIQUIDS AND SOLIDS

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fluid: corrosive!

There's positive control with ASCO SOLENOID VALVES —even in hazardous areas

SPECIAL BULLETIN 8210A

It's a complex matter to control the flow of highly corrosive gases and liquids automatically—even more difficult in areas where an accidental spark could cause instant chaos. Yet the new ASCO Two Way Solenoid Valve with explosion-proof enclosure—designed to meet NEMA VII and UL requirements—provides for just such safe, automatic control.

This all stainless steel Special Bulletin 8210A Solenoid Valve is self contained and requires no separate auxiliary pressure—and can be mounted in any position. Simple design—only two operating parts—the diaphragm and the all stainless steel solenoid core—assures foolproof operation.

The unique design and construction of the full line of ASCO Corrosion Resistant Valves facilitate the use of many special body materials. This is why ASCO Valves adapt to handle almost any corrosive gas or liquid. And ASCO Valves provide absolutely tight seating for pressures up to 1000 psi—function perfectly at temperatures to 450° F. — and are available in ⅛" to 3" pipe sizes. Standard, watertight, or explosion-proof enclosures may be specified.

There's *one* source that solves virtually any solenoid valve problem—ASCO. Have the ASCO engineer call—or write for data: "Solenoid Valves for Corrosive Applications."

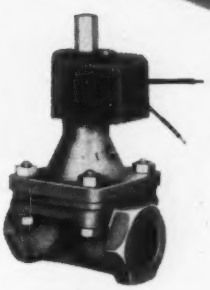
ASCO®

Solenoid Valves

Automatic Switch Co.

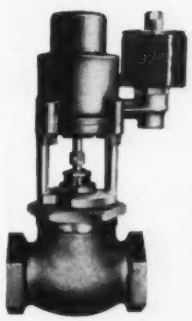
383 Lakeside Avenue • Orange, New Jersey

Here are other typical ASCO *Valves for two and three way corrosive applications.*



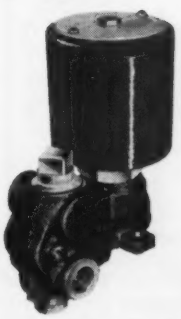
SPECIAL BULLETIN 8336

Especially suited for tight shut-off control of highly corrosive fluids containing suspended solids. Various body materials and diaphragms may be specified.



BULLETIN 8338

Cylinder operated, solenoid pilot controlled, closes on loss of auxiliary pressure. Construction makes it possible to use body materials that suit the corrosive fluid.

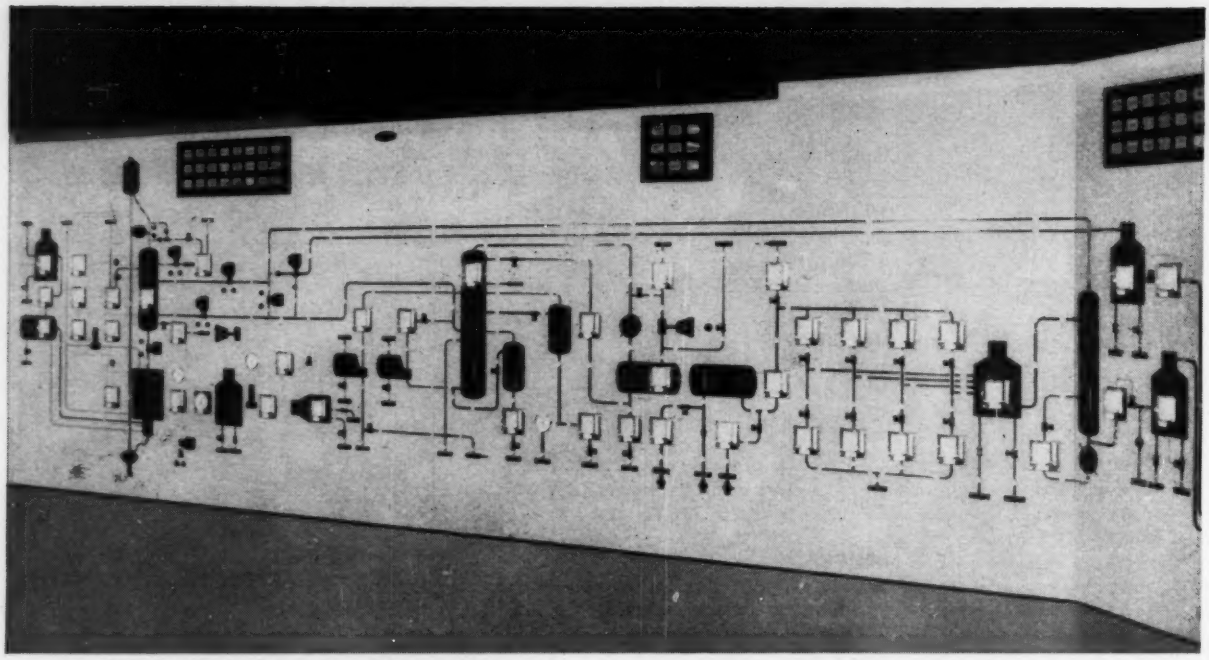


BULLETIN 8300

A three way valve for directing flow from a common inlet into one of two outlets. Available in all iron, steel, or stainless steel construction.

Visit Our Booth, No. 646, at the 25th Exposition of Chemical Industries

BRISTOL'S
Metagraphic Receiver line



THIS TYPICAL GRAPHIC PANEL OF BRISTOL METAGRAPHIC INSTRUMENTS IN AN OIL REFINERY FEATURES:

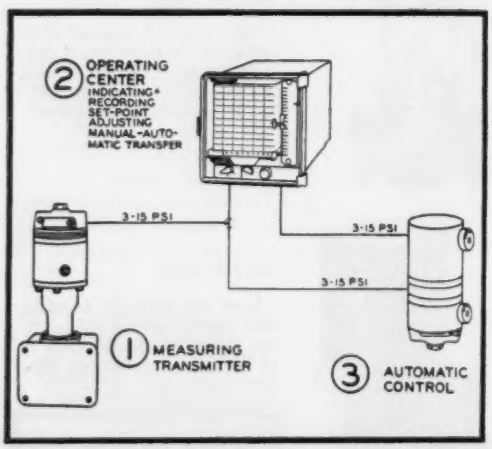
Human engineered, scientifically designed scales for error-free close-by, as well as distant, readability.

Molded clear plastic doors improve visibility to the limit – no shadows or reflections.

All measurements are on the same scale plate.

The instrument presents readings to the process operator in the most easily grasped form. High-visibility, colored fluorescent paints are used on pointers to enable operators to easily tell them apart. All pointers for a given function are the same color in all instruments.

A new degree of performance, flexibility, and ease of servicing in a pneumatic receiver



HOW THE METAGRAPHIC RECEIVER HOOKS INTO CONTROL SYSTEM. Note that Metagraphic Receiver is *outside* the control loop. As a result, unplugging the receiver creates no transient disturbance in the control loop.

FULL PLUG-IN SERVICE: The chassis of a Metagraphic receiver is built for full plug-in service. It is of one-piece construction and can be withdrawn to an intermediate position for servicing, without interrupting its operation, or completely removed from the case (no tools required).

Flexibility. Full plug-in construction provides a flexibility of use that can't be matched. A recorder can be changed to an indicator or vice versa in less than 10 seconds by merely replacing chassis. One model can be changed to another or, if trouble is suspected, the doubtful unit can be replaced by a spare.

No interruption whatever to automatic control when receiver chassis is removed. The set point and manual-automatic transfer station are part of the receiver case. With the chassis removed from the case the controller functions as a blind controller. You get the same automatic control with chassis removed.

When a recorder chassis is replaced the chart can be easily removed and put on the new chassis.

Ease of servicing. Little or no maintenance is required. Simplicity of construction and plug-in feature make it possible, if trouble is suspected, to check receivers while they are still in operation by pulling chassis out to the intermediate position

gives you 35 models to choose from

where it can be inspected, charts changed, pens inked, zero adjusted, and clocks serviced. A receiver suspected of giving trouble can be replaced in a few seconds with a stand-by unit and checked and serviced in the service shop – out of service time is thus eliminated.

Anybody can learn to check and service a Metagraphic Instrument in a few minutes.

CONTINUOUS VALVE POSITION INDICATION on same instrument scale plate as set point scale gives continuous data on control valve position – makes "bumpless" transfer possible, simply by matching pointer positions – no need to read actual scale values – minimizes reading errors – speeds operations.

IDEAL FOR GRAPHIC PANEL AND CONSOLE USE: More instruments can be mounted in a given panel area than with any other type of receiver.

They fit into a 4-9/16″ square cut out – no notches required.

They mount 6-1/2″ center to center on panel (6-1/2″ and 7″ with controller plugged into receiver case).

SCALES ARE SCIENTIFICALLY DESIGNED for instant, error-free readability – a new degree of close-up, as well as distant, readability. Control information can be obtained at a glance at distances up to 20 feet by noting whether pointers match – no need to read scales.

OFFERED FOR UP TO 3 MEASURED VARIABLES – With air pressure regulators or air-loaded regulators, three-position manual-automatic transfer valves for automatic control, and six-position (on same knob) transfer valves for cascade control.

ALL MEASURING ELEMENTS in receiver are the same high quality and accuracy. They all indicate on the same scale plate.

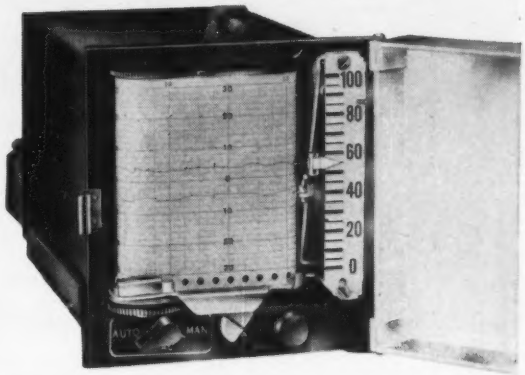
AIR CHART DRIVES are 100% pneumatic operated – no electricity is needed in control room for clock – operates off 20 psi air supply.

UNIVERSAL PIPING MANIFOLD can be adapted to any piping (2-pipe or 4-pipe system). Only a screw driver and wrench needed – no parts required.

HIGH-VISIBILITY COLORED FLUORESCENT PAINTS are used on pointers so operators can easily tell them apart. Pointers for a given function are the same color in all instruments. Control information can be obtained at a glance at distances up to 20 feet by noting whether pointers match or have deviated from each other – no need to read scales.

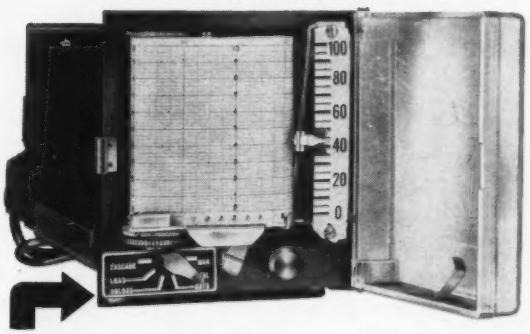
Write for the Bristol Metagraphic Receiver bulletin. The Bristol Company, 109 Bristol Road, Waterbury 20, Conn. 5.31

TWO-PEN RECORDING RECEIVER



THIS METAGRAPHIC TWO-PEN RECORDING RECEIVER, with Manual-Automatic Station records, indicates, and controls one measured variable, records one related variable on the same chart, and gives a continuous indication of either set-point or valve-position whichever is desired. If valve position is chosen to be continuously indicated, set-point may be indicated by depressing the valve knob or vice versa. The two recorded variables are at *no time* disturbed.

SIX-POSITION TRANSFER VALVE



SIX POSITION TRANSFER VALVE (on one knob) for cascade control.

Metagraphic instruments measure, record, indicate and automatically control:

Pressure	Liquid Level
Vacuum	Flow
Absolute Pressure	Temperature and
Differential Pressure	Mechanical Motion

BRISTOL

POINTS THE WAY IN HUMAN-ENGINEERED INSTRUMENTATION

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

◀Highly polished steel, stored in this dehumidified room, is ready for immediate use. No costly, time-consuming cleaning operation is required, since the steel was completely degreased before it was placed in storage.

▼These three Lectrodryers, working with refrigeration equipment, keep an entire building at a low dewpoint.

Are your products in dead storage or "in readiness"?

"DEAD STORAGE" usually means exactly that—products deteriorating day after day and requiring expensive, time-consuming labor to get them back on your live list. DRY storage eliminates this waste. Materials retain their original high quality, often need no other protection, and are held in constant readiness.

DRY storage is insurance against depreciation. But unlike insurance, it pays off constantly by safeguarding your investment and cutting the cost of getting materials ready for use. The Army, Navy, and Air Force demonstrated its worth beyond question.

DRY storage calls for dehumidification machinery and an area properly insulated against infiltration of moisture. If you have a storage problem—or if your processes require DRYing of air, gases or organic liquids—ask Lectrodryer* for help. Our engineers have been answering DRYing questions for years, recommending methods and equipment.

The book, *Because Moisture Isn't Pink,* describes many of these DRYing jobs. For a free copy, or for help on dehumidification, write Pittsburgh Lectrodryer Corporation, 303 32nd Street, Pittsburgh 30, Pennsylvania.

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI.
In Belgium: S. A. Belge Stein et Roubaix, 320 Rue du Moulin, Bressoux-Liege.

LECTRODRYERS DRY WITH ACTIVATED ALUMINAS

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For All Types of Systems...

BS&B Type 86 Diaphragm Control Valve Is The "Workhorse" Of The Industry!

Controls Flow For:
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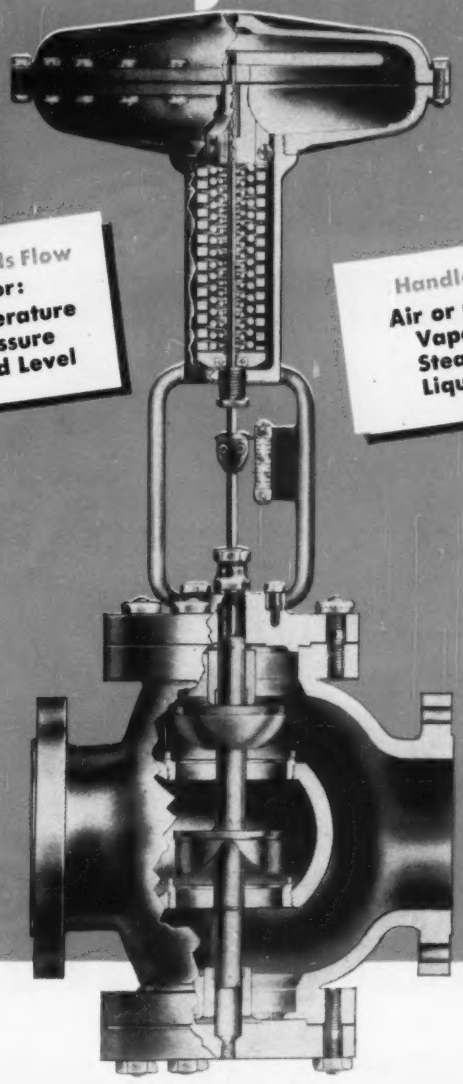
Pressure
Liquid Level

Handles:
Air or Gas
Vapor
Steam
Liquid



- ✓ Wide Range of Application
- ✓ Wide Selection of Trim Characteristics
- ✓ Wide Rangeability
- ✓ Double Port—½" to 16"
- ✓ Single Port—½" to 8"
- ✓ Reversible Inner Valves

Take Both The GUESS And The WORK Out Of Controls Sizing For Liquid, Steam And Gas Applications By Using BS&B's New And Exclusive Sizing Method, As Set Forth In Our New "Controls Sizing Manual." Available On Request From Your BS&B Representative.

EFFICIENCY
OVER 60 YEARS
BS&B
RELIABILITY
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SPECIFICATIONS

Body Size: Double Port, ½" to 16". Single Port, ½" to 8"
Body Style: Screwed Globe and Flanged Globe.
Pressure Range: 125 to 5,000 lbs. within body size limits.
Temperature: Up to 800° F.
Diaphragm Pressure: 3 to 15 lbs., standard.
Material: Body—high tensile cast iron, electric cast steel, or special alloys. Trim—bronze or 18-8 stainless steel or special alloys.

If You'd Like More Information, Contact Your Nearest BS&B Representative, Or Write To...

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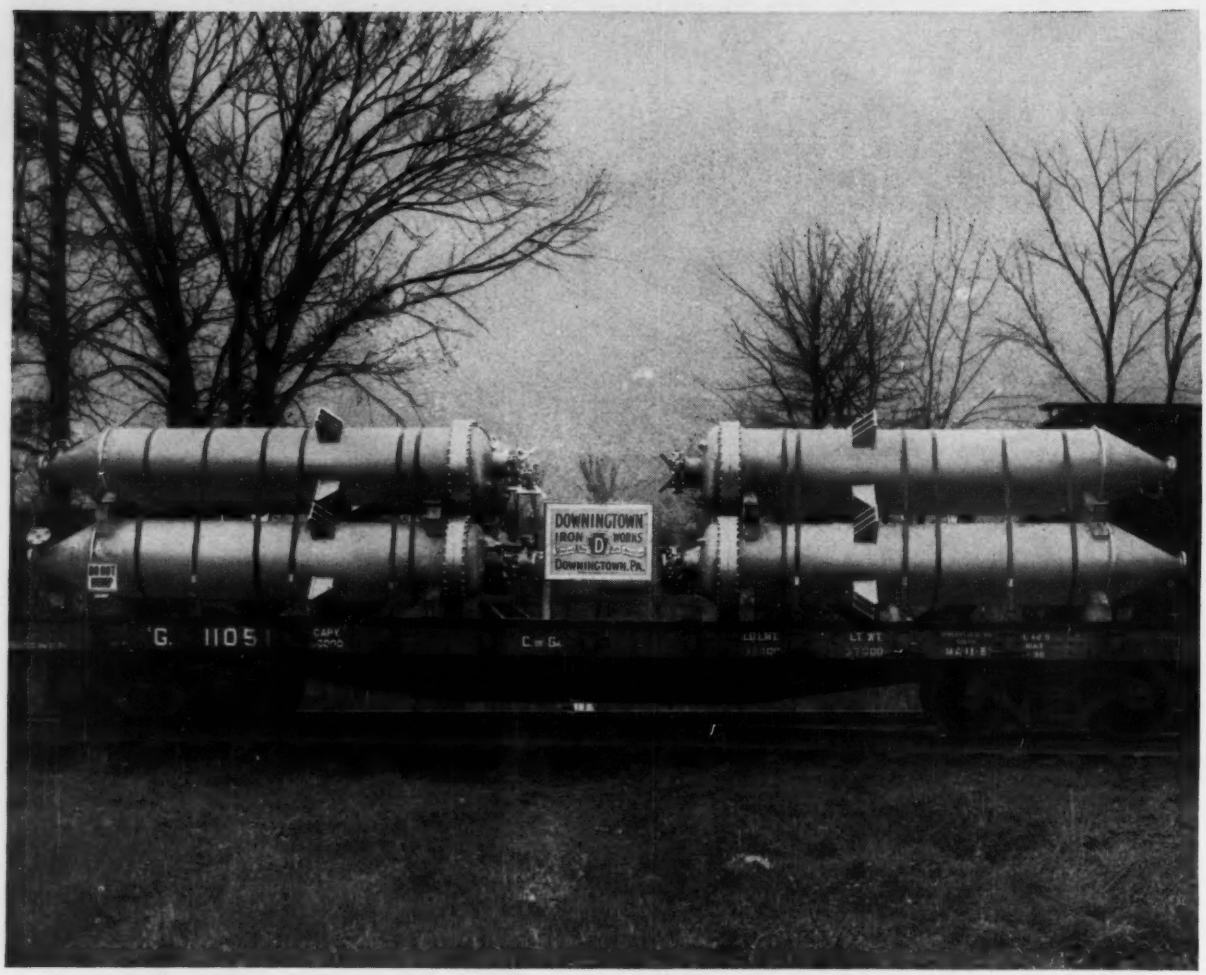
Controls Division, Dept. 4-N11
7500 East 12th Street
Kansas City 26, Missouri



Another carload shipment of 8 process tanks, each 32" O.D. by 13'0" long, fabricated at Downingtown of stainless steel, type 304.

REPEAT ORDERS PROVE

Downingtown Built means Quality Built

These eight stainless steel process tanks form just one of many carload shipments ordered by one customer during the past several years.

Complete satisfaction with workmanship, price and delivery—that's why so many leading chemical, refinery and other process plants turn to Downingtown again and again with repeat orders for their complex plate fabrication work.

They know they can call on our experienced staff of engineers to help work out complex design and construction details. They know they can rely on Downingtown skill and experience for quality workmanship. They know Downingtown is thoroughly experienced in working and welding many alloys and clad materials, as well as the carbon steels and stainless steels.

Put your plate fabrication problems into experienced hands—at Downingtown Iron Works. Code work a specialty, and authorized insurance company inspection regularly available.

For further information, send for bulletin PF.

Visit Us At the Chemical Show—Booth 714

Downingtown Iron Works, Inc.

140 Wallace Ave., Downingtown, Pennsylvania

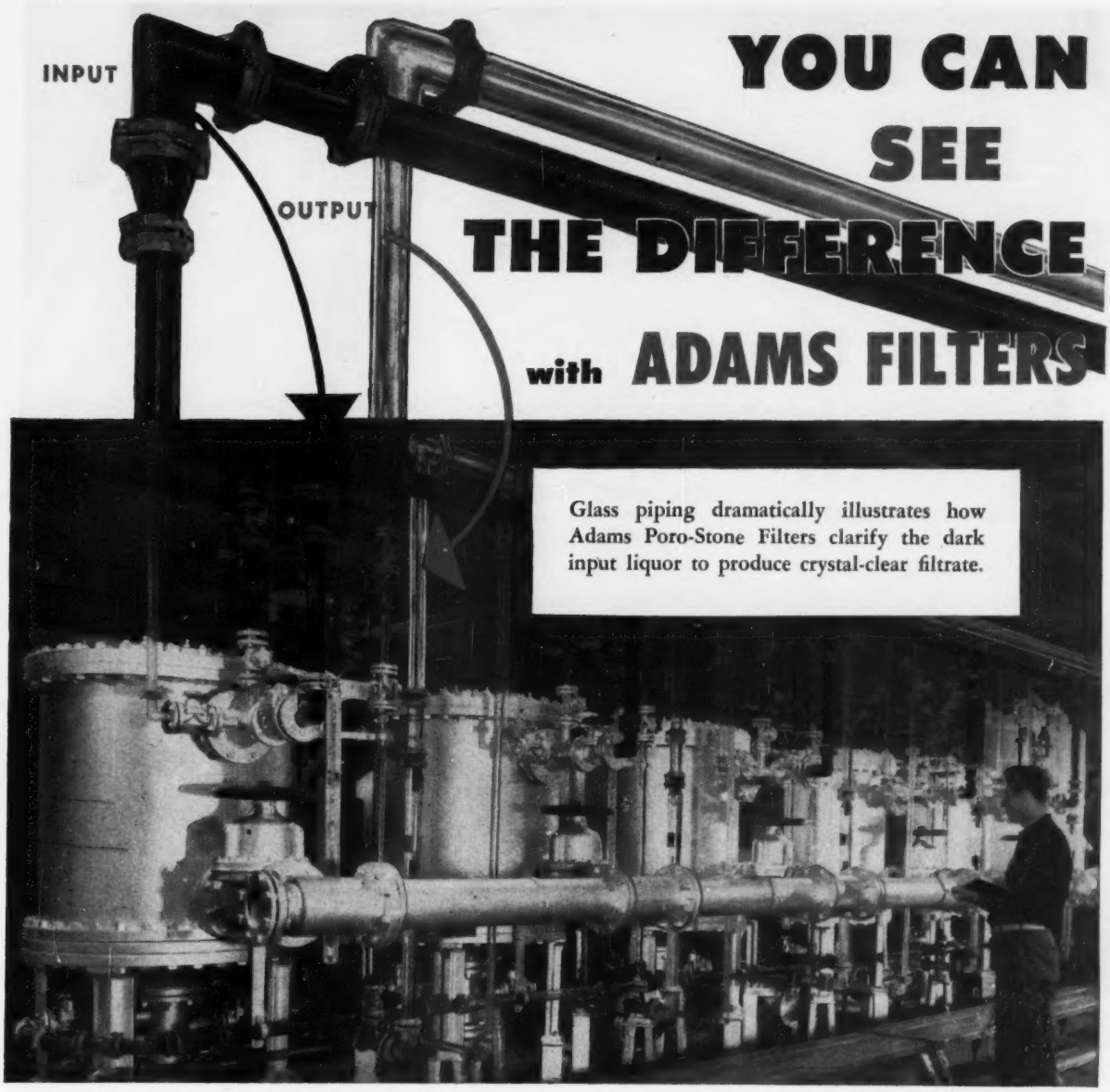
New York Office: 52 Vanderbilt Avenue, New York 17, N. Y.

HEAT EXCHANGERS • TOWERS • PRESSURE VESSELS • STORAGE TANKS • STEEL AND ALLOY PLATE FABRICATION

DIVISION OF: Pressed Steel Tank Company

Manufacturer of Hackney Products • Milwaukee 14, Wisconsin

CONTAINERS AND PRESSURE VESSELS FOR GASES, LIQUIDS AND SOLIDS


INPUT
OUTPUT
YOU CAN SEE THE DIFFERENCE
with ADAMS FILTERS
Glass piping dramatically illustrates how Adams Poro-Stone Filters clarify the dark input liquor to produce crystal-clear filtrate.

Dramatic Results with ADAMS Poro-Stone Filters at BECCO

Efficient filtration is a critical process requirement in the electrolytic preparation of hydrogen peroxide. Thus at the Buffalo plant of the BECCO Chemical Division, Food Machinery and Chemical Corporation, the most effective filtration equipment was vitally necessary.

Finely divided iron compounds are precipitated during purification of the cathode liquor. This precipitate must be completely removed before recycling the filtrate to the cells to insure high process efficiency and ultimate product purity.

Adams Filters with inert Poro-Stone media were chosen for this critical filtration process in the initial installation. Rubber lined construction and glass piping were also specified to prevent any possibility of product contamination.

Increasing demand for BECCO high-purity peroxide made additional production facilities necessary in 1949 and again in 1951, plus another installation in their new west coast plant. On the basis of their excellent performance, Adams Poro-Stone Filters were specified in each case.

Do you have any filtration problems in your process? Our Engineering Department will be glad to be of help. For general information on Adams Chemical Filters write for a free copy of Bulletin 431.

R. P. ADAMS CO., INC.
207 E. PARK DRIVE BUFFALO 17, N. Y.

NATURALLY manufacturers take every possible precaution to avoid contamination in making their products. Don't let *your* quality control end there by shipping your product in containers that are not 100% free of scale, grease and dirt. With USS Steel Drums you can maintain product purity right to your customers' door. Here's why:

AFTER each USS Steel Drum has been carefully shaped, formed and welded, a strong alkali bath cuts away all dirt and grease. Next, the interior *and* exterior are completely descaled. This process is followed by saturating all surfaces with a special phosphate solution that retards rusting. These three careful steps are an assurance that your product, shipped in USS Steel Drums, arrives pure . . . always! USS Steel Drums are available in a wide variety of shapes, sizes and finishes . . . plain or decorated.

UNITED STATES STEEL PRODUCTS
DIVISION
UNITED STATES STEEL CORPORATION,
DEPT. 2115, 30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.
Los Angeles and Alameda, Calif. • Port Arthur, Texas • Chicago, Ill.
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USS STEEL DRUMS

USS

UNITED STATES STEEL

POSITIVE DISPLACEMENT

NO STUFFING BOX

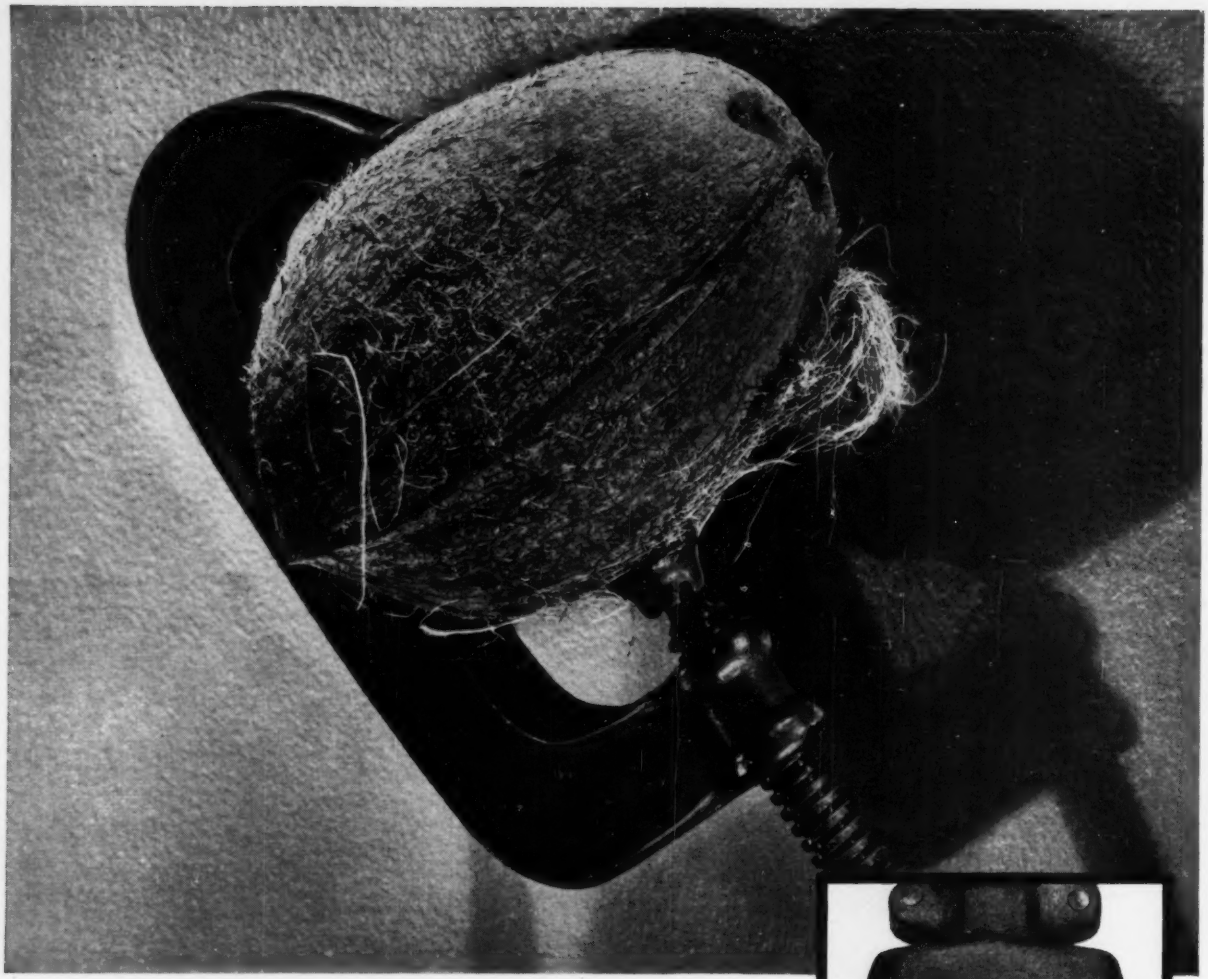
Specify Lapp Auto-pneumatic PULSAFEEDER

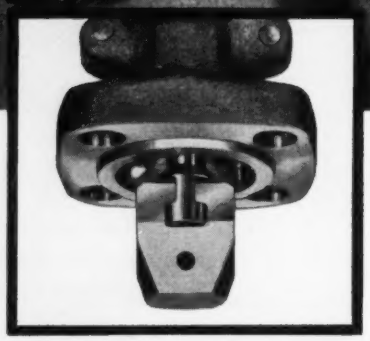
. . . for Automatically Controlled Metering of Liquids

The outstanding features of the Lapp "Auto-Pneumatic" Pulsafeeder make possible continuous automatic processing of liquids which cannot be satisfactorily handled by plunger-type metering pumps. The "Auto-Pneumatic" Pulsafeeder is a piston-diaphragm pump providing positive displacement without the problems of a stuffing box. A hydraulically balanced Pulsafeeder diaphragm isolates the product from the working parts of the pump, preventing product leakage or contamination. With pneumatic instrument control, the pumping rate of the "Auto-Pneumatic" Pulsafeeder automatically adjusts from zero to full capacity. Manually adjustable models also available.

WRITE FOR BULLETIN 440 *with typical applications, flow charts, description and specifications of models of various capacities and constructions. Inquiry Data Sheet included from which we can make specific engineering recommendation for your processing requirement. Write Lapp Insulator Co., Inc., Process Equipment Division, 473 Wilson Street, Le Roy, New York.*

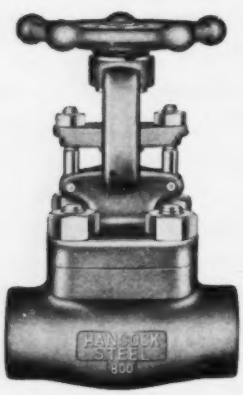
Lapp





STAMINA

that takes heavy loading



THE STEM-WEDGE CONNECTION in Type 950 Hancock Steel Gate Valve won't bend or fracture even if corrosion prevents opening the valve. So strong is the connection that destructive "cheater" loading on the handwheel will first break the stem thread. The operator thus knows that the valve is still closed and can act to safeguard equipment and avoid shutdowns.

This ultra-strong stem-wedge connection, *an exclusive Hancock design*, overcomes a structural weakness widely recognized in other small gate valves. Its balanced design also places the "T" head slot in the wedge so that the stem can move freely, even though flow forces the wedge against the guides. It is a powerful example of the quality that makes Type 950 Hancock Steel Gate Valves perform better and longer in the severest services. Call your Industrial Supply Distributor for full details today.

HANCOCK VALVES

A product of

MANNING, MAXWELL & MOORE, INC.

Watertown 72, Massachusetts

In Canada: *Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario*

what if you could hire Paul Bunyan to dip your plant in "aluminum paint?"

(most of your maintenance problems would be gone!)

Good aluminum paint actually puts a *protective shield* on rustable metal and masonry surfaces. It resists corrosion from fumes and smoke; seals against moisture and rust; reflects light and heat—makes everything brighter; evaporation of volatiles is reduced; heat expansion is held to a minimum.

Alas, Paul Bunyan is not for hire. BUT...

IT'S JUST ABOUT THAT EASY!
ONE COAT of Aluminum Paint LASTS and LASTS

Labor—the largest cost in painting—is low because only one coat of aluminum paint is needed in most cases. Here, then is a way to slash your plant maintenance costs without sacrificing protection.

Reynolds Metals Company does not make aluminum paint. But if you would like the names of manufacturers who rely on the high quality of genuine Reynolds Aluminum Pigments, we'll gladly send you the list. Just use the coupon below.

THAT GOES FOR ROOFS TOO!
Buy Aluminum Roof Paints and Coatings with this Warranty Seal

They protect rustable metal and built-up roofs, add years to roof life and keep interiors cooler in summer. Increase employee efficiency, cut cooling costs. Insist on Asphalt-Aluminum roof paint or coating with this Warranty Seal. It assures you of an approved vehicle and at least two full pounds of pure aluminum metal pigment in every gallon.

Reynolds Metals Company
P. O. Box 1800-PN, Louisville 1, Kentucky

Please send information on Aluminum Paints and Roof Coatings.

☐ Send list of aluminum paint manufacturers
☐ Send list of asphalt-aluminum roof coating manufacturers

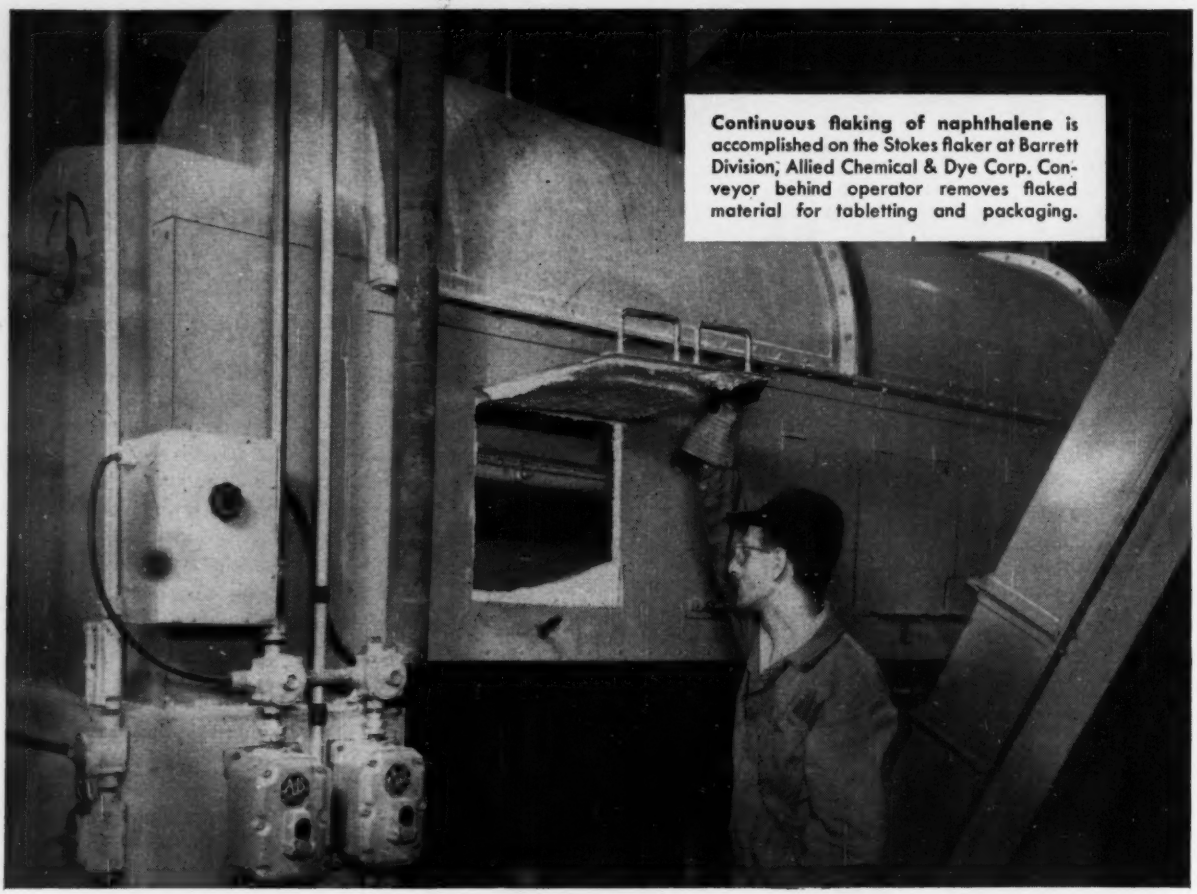
Name .....

Company .....

Address .....

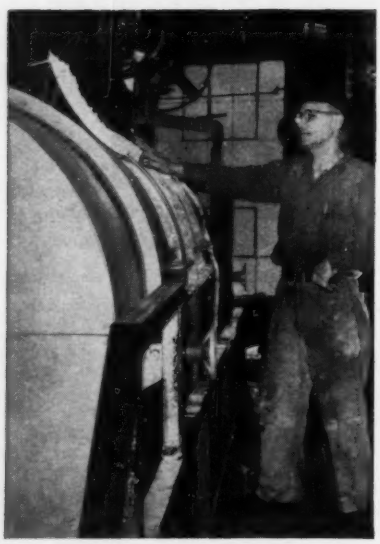
City ..... Zone ..... State .....

This advertisement appears in the interest of the Paint Industry of America



Continuous flaking of naphthalene is accomplished on the Stokes flaker at Barrett Division, Allied Chemical & Dye Corp. Conveyor behind operator removes flaked material for tabletting and packaging.

Barrett improves quality, cuts costs in naphthalene production



Purity is higher, costs lower with continuous flaking process. Flaked naphthalene is compressed into balls or rings, with the aid of Stokes tabletting machines.

Stokes flaker replaces batch method in the processing of moth-killing chemical

Marketed in flakes, balls and handy rings which slip over the hook of coat-hangers, naphthalene is the housewife's friend—and the moth's worst enemy.

At the Barrett Division of Allied Chemical & Dye Corp., molten naphthalene at 194°F. is fed to a Stokes single drum flaker where the material crystallizes on the revolving drum. The solidified naphthalene is removed by a doctor blade at 72°F. in quantities ranging up to 1500 pounds per hour. Subsequent tabletting operations on Stokes tablet machines produce finished moth balls and rings.

Before purchasing the flaker, Barrett called on the Stokes Advisory Service and Laboratory for recommendations. Tests in the Stokes Laboratory determined the appropriate drum temperature, rotating speed and size of the unit required to give desired production. Similar tests have preceded the design of flakers for wax, insecticides, resins, many chemical intermediates and other products suited for high capacity flaking.

Stokes makes its broad experience in all phases of chemical processing available to manufacturers through this well-staffed Laboratory and Advisory Service. Full details of this laboratory and advisory service for the solution of production problems are covered in Bulletin 640.

Send for this booklet as well as an informative brochure on Stokes equipment for the Chemical & Processing Industries. F. J. Stokes Machine Company, Philadelphia 20, Pa.

STOKES

ALUNDUM*

High-Purity Fused Alumina

How can you use it to advantage?

Among the many electrochemically refined materials produced by Norton Company, ALUNDUM fused alpha alumina is one of the most widely useful to industry. Thanks to its inherent properties of hardness, chemical stability and high density, engineers in various fields are finding many new applications for it.

Norton fused alumina is produced in a number of forms. Of these, 38 ALUNDUM* grain has proved particularly successful in applications demanding high purity. Electrically fused from Bayer-processed alumina, this white grain is shown by typical chemical analysis to be 99.49% pure Al_2O_3. It is insoluble in common solvents and extremely resistant to reduction. It is an amphoteric refractory and has high dielectric strength. Other characteristics include:

Melting point	**about 3600°F.**
Specific gravity	**3.94**
Crystal structure	**hexagonal system (rhombohedral division)**
Hardness	**9.0 Mohs' scale**
Index of refraction	**1.76 mean**

Typical Product Applications in which Norton high-purity fused alumina is now working out to advantage are:

For Catalytic Reactions. Norton fused alpha alumina carriers are outstanding for chemical stability and resistance to abrasion and erosion. Available in the form of spheres, rings and pellets they are used both in fixed bed oxidation reactions and as inert, low-density carriers for space filler applications where a low surface area (less than $1 m^2/gm$) is required. Other types of ALUNDUM catalyst carriers having surface areas in the range 5-60 m^2/gm are also available.

In Pebble Heaters. ALUNDUM heat exchange pebbles are giving excellent results in pebble heaters for heating gases above operating temperatures permissible in conventional tube furnaces. Their great resistance to abrasion, impact and repeated heating and cooling make them the ideal heat transfer medium in these devices. Also, their high refractoriness prevents them from the softening and "bridging" together that causes stoppages in the heater's moving bed.

In Thermal Cracking Reactors. Particularly in Wulff Process Generators for cracking light hydrocarbons to produce acetylene gas and Koppers-Hasche Generators for cracking light hydrocarbons to produce a variety of gases and petrochemicals — checkers made of Norton ALUNDUM high-purity fused alumina provide definite advantages. Their excellent heat transfer properties, high refractoriness and resistance to erosion caused by hot gases are important Their ability to withstand the thermal stresses of intermittent operation assures long life. And their purity prevents side reactions with the reacting gases, thus safeguarding product quality.

In Gas Synthesis Generators. ALUNDUM fired shapes are ideal for lining generators of this type. Among the inherent characteristics of Norton high-purity fused alumina that work out very well are: high refractoriness, chemical stability, and inertness that prevents reacting with the contacting atmospheres.

Very many other uses for Norton high-purity fused alumina materials include: pure oxides and sintered refractories, refractory cements, wear-resistant parts, laboratory ware, coatings for rocket and jet plane parts and atomic energy equipment.

Other Norton Electrochemically Refined Materials

include CRYSTOLON* silicon carbide, MAGNORITE* magnesium oxide, NORBIDE* boron carbide, FUSED ZIRCONIA and many others, including a number still under development. These high-melting materials, which have varied applications in many fields, are also the basic ingredients of the famous Norton Refractory Rx's — refractories *engineered and prescribed* for the widest range of uses.

For Your Own Applications Or Developments

Norton Company not only supplies these materials in crude form, but has extensive facilities for processing and fabricating — and is ready to work with you in engineering materials to your particular requirements. A new booklet "Norton Refractory Grain — Electrochemically Refined" contains detailed information. For your copy, write to NORTON COMPANY, Refractories Division, 510 New Bond Street, Worcester 6, Massachusetts.

NORTON

REFRACTORIES

Engineered... Rx... Prescribed

Making better products... to make your products better

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

MOTOR FACTS ON INDUSTRY'S
MOST PREFERRED "POWER PACKAGE"

Electrical System Fact—Only the new Life-Line "A" motor gives you the unsurpassed corrosion-resistant protection of exclusive new Bondar, Bondite and Mylar* insulations.

*Du Pont Registered Trade-Mark

FACT:

The new Life-Line A is the most corrosion-resistant motor on the market

The corrosive action of chemicals takes a heavy toll on conventional motors. The new Westinghouse Life-Line® "A" motor offers more protection against corrosive atmospheres than any other motor you can buy. How?

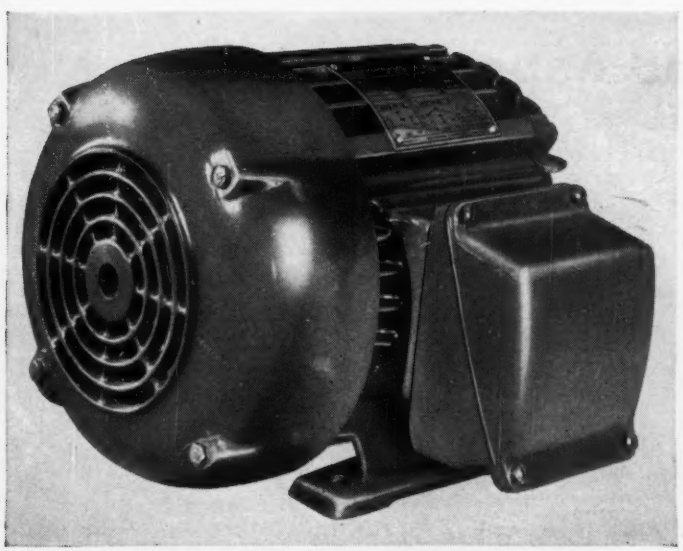
Because the combined improvements in insulation, housing and bearing design give unsurpassed protection against any contamination. It takes the right combination of such improvements in *all three systems*—electrical, mechanical and lubrication—to make the Life-Line "A" industry's most preferred power package.

Get all the facts by calling your Westinghouse sales engineer . . . *The Man With The Facts.*

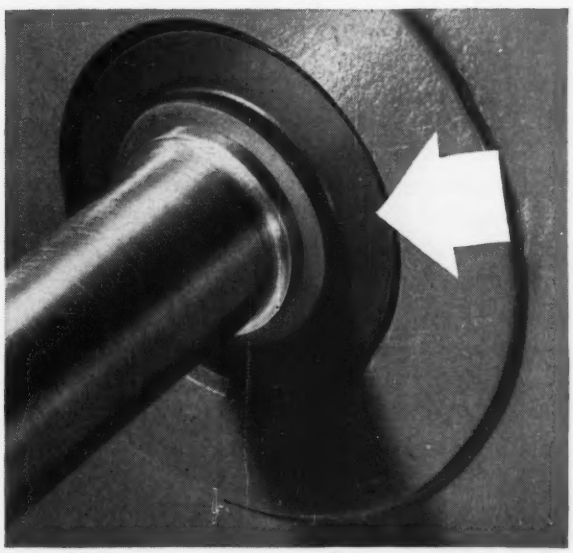
J-21881

YOU CAN BE SURE . . . IF IT'S

Westinghouse

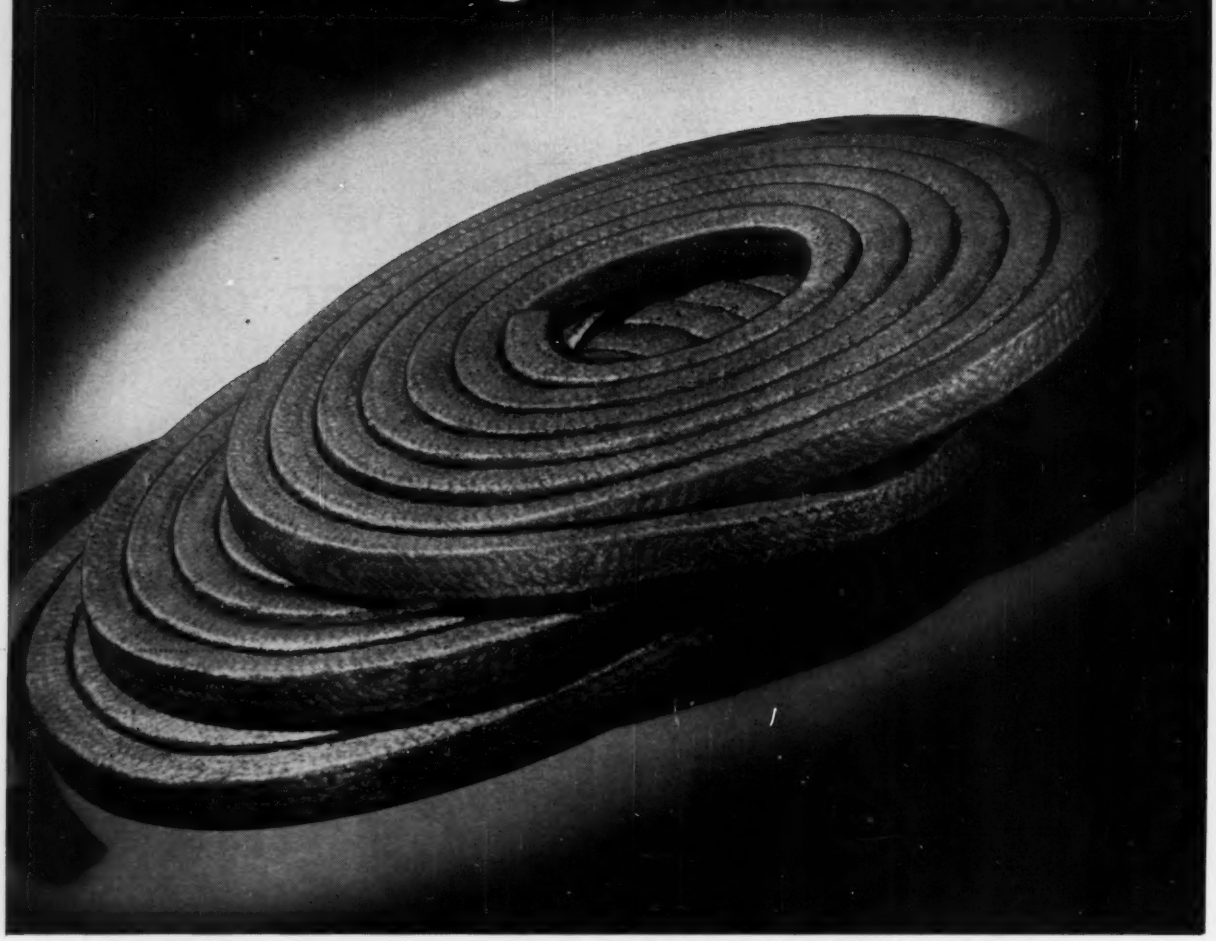


Mechanical System Fact—New cast-iron frames and brackets utilize the finest grained castings with uniformly thick wall sections precisely fitted and sealed. Molded glass plastic cooling fans on totally-enclosed types are chemically inert.



Lubrication System Fact—The new pre-lubricated Life-Line "A" bearing features a "4-way seal"—*two* seals on each side. Totally-enclosed types have additional neoprene flinger which assures bearing protection in any corrosive application.

Handles the strongest chemicals and acids!



Teflon-impregnated
U. S. Braided Asbestos Packing

U. S. TEFLON-impregnated braided asbestos packing is designed for service on reciprocating rods and plungers, valve stems, and centrifugal pumps handling corrosive acid and caustic solutions. TEFLON is completely inert in the presence of almost *all* chemicals. The long-fibre asbestos yarn braided into coil form is thoroughly impregnated with TEFLON and provides the proper density, minimizes friction and wear of rods or shafts.

U. S. 35% TEFLON-impregnated braided packing comes in 2 styles: No. 135 (White Asbestos) for handling light acids, caustics and all chemicals. No. 134 (Blue Asbestos) for handling chemicals of a higher concentration. Order from any of our 27 strategically-located District Sales Offices, selected distributors, or write address below.

"U. S." Research perfects it . . . "U. S." Production builds it . . . U. S. Industry depends on it.

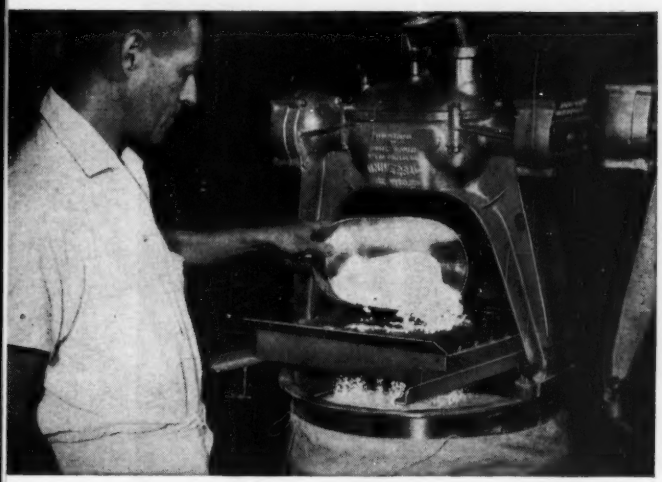
UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION · ROCKEFELLER CENTER, NEW YORK 20, N. Y.

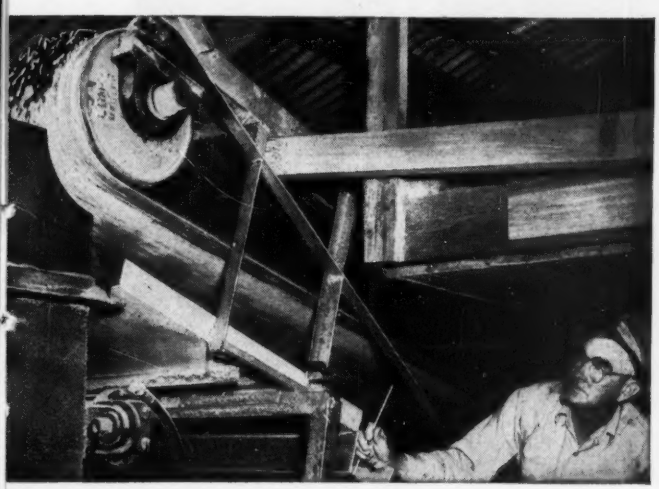
Hose • Belting • Expansion Joints • Rubber-to-metal Products • Oil Field Specialties • Plastic Pipe and Fittings • Grinding Wheels • Packings • Tapes Molded and Extruded Rubber and Plastic Products • Protective Linings and Coatings • Conductive Rubber • Adhesives • Roll Coverings • Mats and Matting

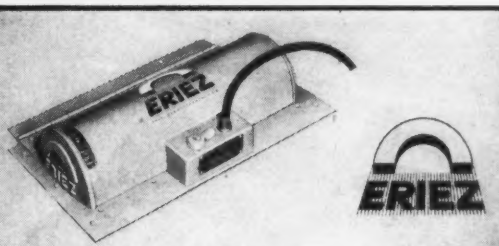
UPSIDE-DOWN ROLLER DERBY? Not at all. The young lady is demonstrating the tremendous power of an Eriez Magnet. Seventeen times stronger than old magneto magnets, the power of new Eriez Magnets has given ideas about getting rid of dangerous tramp iron . . . which causes fires, machinery damage and product contamination . . . to every form of industry. *All Eriez Magnets are non-electric, self-contained. They operate without any wires or attachments. Best of all their magnetic power lasts a lifetime. The first cost is the last.*

MAGNETIC IDEAS FROM ERIEZ



GRATE MAGNET DOES GREAT JOB ON RIDDLE. Burroughs Wellcome & Co. (U.S.A.) Inc., Tuckahoe, N. Y., producers of drugs and chemicals, recently installed an Eriez Permanent Grate Magnet over a riddle used to sift powders. Although there previously had been occasional traces of contamination in the powder due to minute ferrous particles (in some cases invisible to the human eye) the finished product is now completely free of metal contamination. Even microscopic particles of metal have been removed from the powder by the powerful action of the Eriez Grate Magnet.





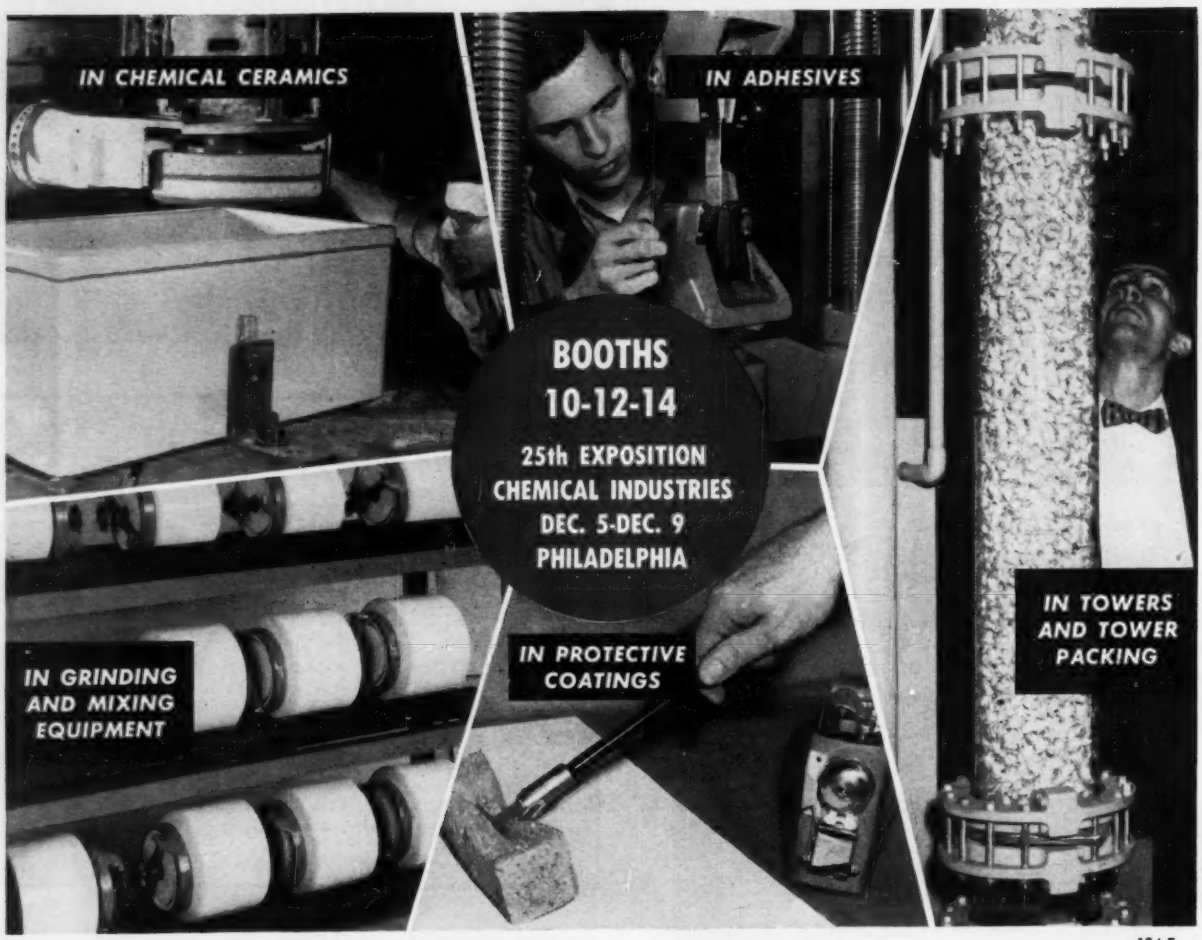
NEW IDEA FOR LABOR SAVING is the latest "brain child" dreamed up by Eriez. Called *Magnalarm*, the new unit combines a plate magnet with a signalling device which automatically sets off an alarm when the magnet becomes loaded with tramp iron and needs cleaning. Needless inspections are saved. Needless machinery shutdowns prevented. *Magnalarm* provides the guarantee that magnetic units are never overloaded . . . always working at top efficiency. Want more information on this product? . . . request Bulletin B-604.

GUARDING EQUIPMENT AGAINST TRAMP IRON. Cal-Compack Foods, Inc., Santa Ana, Calif., processor of dehydrated and ground peppers, protects its valuable 100 hp hammermill . . . and even more valuable reputation for product purity . . . with an installation of an Eriez Magnetic Pulley on its inspection belt. Peppers brought to the plant directly from the field naturally pick up stray iron. The Eriez Magnet cleans out this dangerous tramp iron from the peppers at the rate of about 5 lbs. per day!

●

Eriez' free booklet "Magnetic Ideas" can help you. Send for it without obligation. Address: Eriez Manufacturing Company, 74Y Magnet Drive, Erie, Pa. Or, on your specific request Eriez' factory-trained field men backed by Eriez' laboratory and engineering know-how will be happy to study your particular problem, make a plant survey and offer helpful "Magnetic Ideas".

NEW DEVELOPMENTS YOU'LL WANT TO SEE AT THE CHEM SHOW



184-E

See these, and other new developments by "U. S." engineers to help you process quicker, safer, better, and at lower cost.

U. S. STONEWARE

Akron 9, Ohio

NOVEMBER
1955

Chementator

Edward T. Thompson

• Oil production by underground combustion gets a new U. S. try. Besides Sinclair, which has been using the method on Colorado shales, now Husky Oil (Cody, Wyo.) and a Swedish Shale oil firm have begun work on tar-bearing sandstone near Santa Cruz, Calif.

• Ethylene is rampaging. Monsanto will up its Texas City capacity 150%. Esso, though it refuses to comment, is virtually certain to build a unit at Bayway, N. J. And still much alive is Oronite's planned Perth Amboy, N. J., plant that would charge gas oil.

Atomizing speeds drying

Here's a brand-new chemical engineering technique that bids fair to make a big splash in thermal processing. Christened "atomized suspension," extremely fast heat transfer is its standout advantage. Best potentials are in evaporation, and drying, followed, all in the same tower, by pyrolysis or chemical reaction.

Solutions or slurries are sprayed at high pressure into the top of a tower. All heat comes by radiation from the heated (1,100-1,500 F.) tower walls and the only vapor present is the substance being evaporated so there's no air film to hinder heat transfer.

According to the method's inventor,* Prof. W. H. Gauvin of McGill University, most evaporation occurs in a small fraction of a second in a small zone at the top of the tower where droplets emerge from the spray nozzles at very high speeds. The droplets slow to terminal velocity quickly and a new zone begins in which evaporation is completed and is followed, if desired, by drying.

Because of the near-explosive nature of the evaporation and drying, resultant solid particles are highly porous and have very irregular surfaces (compared with spray-dried particles which are nearly spherical). This gives high surface area and decreases substantially the reaction times for any subsequent steps in the lower part of the tower—relatively simple ones like pyrolysis or more complex ones involving addition of other reactants or catalysts.

When water is being removed, best heat recovery is obtained by operating under pressure (150 psi. and up) so that steam produced can be used in other parts of the plant. If you have no use for additional process steam, use of the technique for evaporation alone is probably not justified.

For drying, though, or for drying and further in situ processing, Gauvin says the method will almost always prove advantageous over existing techniques, the one exception being use with heat-sensitive materials.

* Patent applications are assigned to the Pulp and Paper Research Institute of Canada, which sponsored the research.

Two new fibers coming to the post

The synthetic fiber derby is due to get two new acrylic entries if present plans of Goodrich Chemical and American Cyanamid mature. Watch, too, for coming word on new Tennessee Eastman fibers.

Though rumors have been circulating for two years, Goodrich Chemical only now admits that it has developed a new fiber. In limited production at its Avon Lake, Ohio, pilot plant, it will be used in women's coats for test-marketing in selected stores this winter.

The fiber, tagged Darlan, is made from polymerized vinylidene cyanide and is purported to be

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the result of a search for a polymer usable in tires. Now it appears well suited for textile use, and it also shows promise as a plastic.

Tightlipped, Goodrich won't say when or where it plans commercial production.

Cyanamid's new fiber—now named Creslan, formerly X-54—is in about the same stage of development. Acrylonitrile-based, Creslan features ease and uniformity of dyeing—either alone or combined with wool.

While wear-testing of Creslan garments continues, and a filament-development program is underway, Cyanamid is casing Southern textile mill country for a plant site. Likely: Columbia, S. C.

Eastman says it is evaluating several fibers and has reached wear-testing stages with a few. Among the latter are two noncellulosics understood to show unusual promise.

Commercial thiophene comes true

From a unit that took just three months to install, Index Chemicals (mostly owned by Pennsylvania Salt Mfg. Co.) is now making the world's only commercial thiophene. Located at Index's Houston plant, the new unit is reputed to have a capacity of about 500,000 lb./yr.

That there's big potential interest in thiophene is evident from the more than 250 use patents issued on it and its derivatives since 1945. Most important known uses are in pharmaceuticals (particularly antihistamine intermediates), textile chemicals, including dyestuffs and treating agents, pesticides (substituted thiophenes) and plastics, where, for instance, vinyl thiophene is of interest because it's similar to styrene.

Sales and development of thiophene are in the hands of PennSalt's Sharples Chemicals Div. which directs Index operations. And other firms with patent stakes in the product are reviving lab activity now that commercial output is here.

Right now, price is evidently at a specialty products level since quotations are limited to l.c.l—$2.50/lb. But Sharples expects to drop the price soon as bigger volume markets open up. Process economics definitely improve as production increases.

The process (developed by and licensed from Socony Mobil) is a noncatalytic reaction of sulfur with straight-chain C_4 hydrocarbons. Sulfur is melted, vaporized and heated to about 1,300 F. Butane fresh feed and a recycle stream containing unreacted butane, butylenes and butadiene are heated to about 1,150 F. and mixed with the hot sulfur vapors in a straight-pipe reactor.

Reactor effluent is quenched with water to drop out most of the coproduct "tar" (largely thiophene thiol). The remaining gas is condensed, then stabilized to remove H_2S and light hydrocarbons. Debutanization follows, giving crude thiophene and C_4-recycle. Batch distilling the former yields better than 98%-pure thiophene.

In and out with fast tax writeoffs

Though some segments of the chemical process industries—notably aluminum—have been permanently cut off from fast tax writeoffs, it now begins to look like there may be a new round of rapid amortizations ahead for some directly defense related chemicals.

Approval by the Office of Defense Mobilization of a boost in the synthetic glycerine expansion goal from 57 million lb./yr. to 185 million lb./yr. (current capacity: 120 million lb./yr.) was the guinea pig for chemical mobilizers. Since the okay they've been informally discussing other chemicals that might be over 25% short in an emergency, with a view to opening further expansion to fast depreciation benefits. Some candidates: benzene, toluene, sodium chlorate, phosphorus, ammonia-nitric acid.

But even without government tax aid, most process industry expansion will go ahead as planned. That's particularly apparent in aluminum, where three firms—Reynolds, Kaiser and Revere Copper—which had applied for fast writeoffs on plants costing $440 million have stated flatly that the government's decision makes no difference in their plans.

Styrene finds new raw material

Mixed xylenes, in growing demand as solvents and as sources of pure xylene isomers, are about to gain another chemical foothold—as raw material for styrene. First to use this new starting point will be Cosden Petroleum, Big Spring, Tex., which plans to start building a $3 million, 19-million-lb./yr. styrene monomer plant early next year.

Like all present styrene makers, Cosden plans to catalytically dehydrogenate ethyl benzene. But unlike the others, who make ethylbenzene by alkylating benzene, Cosden will get EB by superfractionating its own mixed xylenes.

Mixed xylenes normally contain significant amounts of EB (Cosden's have 27%). But because EB boils less than 4 deg. F. away from p-xylene, it's tough to get out, next to impossible if any non aromatics are present.

(Continued on page 110)

NEW FEEDERS . . .

OMEGA CONTINUOUS
LIQUID OR SOLIDS
LOSS-IN-WEIGHT
FEEDERS

PROPORTIONEERS
VANE-GUIDE* CHECK VALVE
ADJUST-O-FEEDERS

NEW FEATURES . . .

- UNLIMITED APPLICATIONS — feed by weight all types of solids (powders, coarse particles, cut vegetables, etc.) and liquids (clear, suspensions, pulps, etc.). Also adaptable to stream weighing.
- HIGHEST ACCURACY — within ±½% by weight of set feed rate over entire range.
- BUILT-IN MEMORY — dead weight system automatically totalizes and corrects shortages or overages.
- A MODEL FOR EVERY USE — Simplex and Duplex for feed rates from 1 to 60,000 #/hr. Available with remote controls (electrical, pneumatic).

See this latest advance in automated materials handling at the Chem. Show, Booth No. 902, or write for details to OMEGA MACHINE CO., Division of B-I-F Industries, Inc.

- EXCEPTIONAL FEEDING ACCURACY — with Proportioneers NEW Vane-Guide check valves and minimum clearance volume cylinders . . . self-purging with straight-through design.
- EASY-SERVICE DESIGN — plug-in reagent end . . . other mechanical components all readily accessible and of standard design . . . reversible check valve seats.
- POSITIVE FEED RATE SETTING — micrometer stroke length adjustment on all standard models . . . available with in-motion rate adjustment.
- COMPACT DESIGN—easily installed . . . saves floor space.
- NEW LOW COST — check our quote on any feed rate from 4 GPH to 900 GPH!

See Proportioneers New Vane-Guide Check Valve Adjust-O-Feeders at Booth No. 902, or send for quote to PROPORTIONEERS, INC., Division of B-I-F Industries, Inc.

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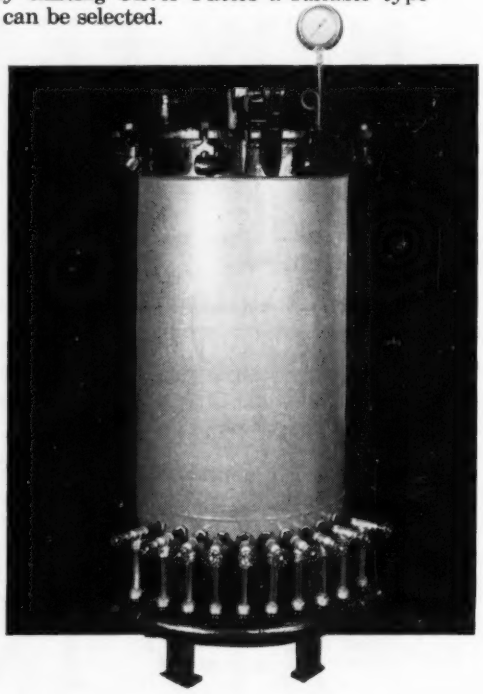
Oliver Batch Pressure Filters are particularly applicable to clarification of liquids containing small amounts of solids, or for products involving volatile, inflammable or toxic materials. They are available in a number of types including units for processes that require operation to the exclusion of air to prevent oxidation or decomposition of products . . . or operation that requires filtration to take place at abnormal temperatures.

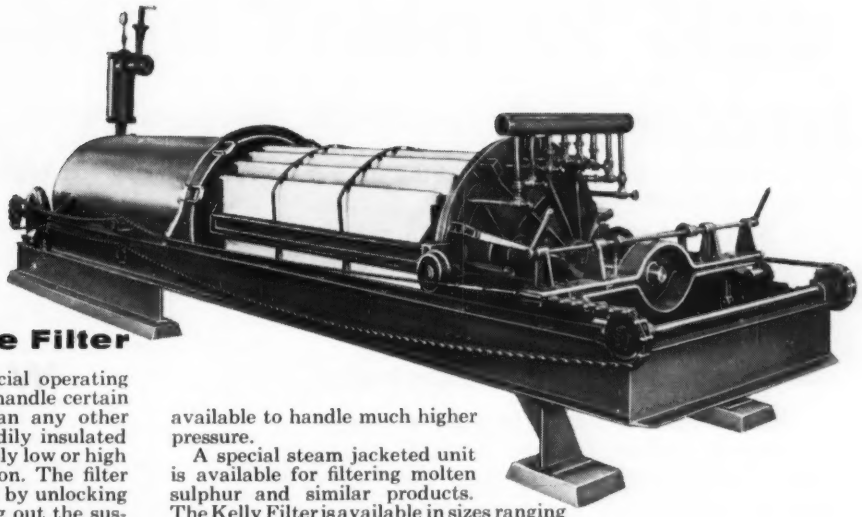
Oliver features include individual sight glass and shut off valve control for each leaf, high capacity, high washing efficiency, ease of cake discharge, low cost operation, and rugged construction which assures long life.

Dorr-Oliver engineers will be glad to place their many years of exclusive experience at your disposal for solving your filtration or clarification problems. It is probable that from one of the many existing Oliver Filters a suitable type and size can be selected.



Oliver Pressure Filter

A compact, rugged, simple to operate filter for filtering or polishing chemicals, dyes, fruit juices, syrups, wine, beer, ink and other liquids requiring clarification. It is especially designed to insure cleanliness and ease of sterilization. The ratio of filter area to filter volume has been kept at the very maximum consistent with practical filter operation. Available in three sizes with up to 100 sq. ft. of filtering area. Bulletin 123-R gives complete details. Write for your copy.



Kelly Pressure Filter

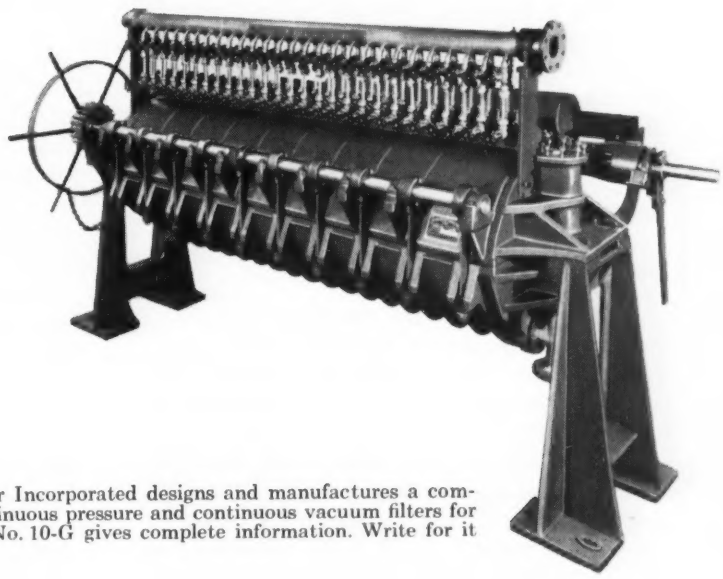
The Kelly Filter has special operating features which enable it to handle certain unique problems better than any other type of filter. It can be readily insulated or jacketed to hold abnormally low or high temperatures during filtration. The filter opens in a matter of seconds by unlocking the manifold end and rolling out the suspended filter elements for cake dumping and removal of leaves. Normal pressure is about 50 psi, but special designs are available to handle much higher pressure.

A special steam jacketed unit is available for filtering molten sulphur and similar products. The Kelly Filter is available in sizes ranging from 3 to 1300 sq. ft. of filtering area. Bulletin 113-R2 gives complete details. Write for your copy.

Pressure Filters

Sweetland* Pressure Filter

The most versatile general purpose filter in the batch pressure group. Outstanding features include high filtration rate, ease of operation, variation in leaf spacing and in design of leaves which may be top or bottom drainage. Filter cake is easily discharged after lower half of shell is opened in a matter of seconds, either manually or hydraulically; or by automatic sluicing discharge without opening the filter. Several sizes available with up to 1000 sq. ft. of filtering area. Bulletin No. 114 gives complete details. Write for your copy.



For Further Information . . . Dorr-Oliver Incorporated designs and manufactures a complete line of batch pressure, continuous pressure and continuous vacuum filters for the process industries. Bulletin No. 10-G gives complete information. Write for it today.

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However, Cosden now runs a Udex extraction unit, so already has a 100% aromatic stream. By superfractionating the xylene portion of this stream in a system equivalent to about 350 trays, the company, and its contractor for the plant, E. B. Badger, expect to get EB at minimum cost, cheaper even than by recovering ethylene from its own field gas and reacting with the benzene it already makes.

Outlook happier on pesticide law

Makers of agricultural chemicals who have feared an over-careful approach by the Food and Drug Administration in carrying out the Miller pesticide tolerance law could breathe easier this month.

Reason: the establishment of a 1 ppm. tolerance on U. S. Rubber's Aramite. FDA had originally set a zero tolerance on the miticide—in effect barring use on edible crops—because of recognized carcinogenic (cancer-forming) properties at a 1,500 ppm. feeding level, and some disputed evidence at a 500 ppm. level.

The company asked that an impartial advisory committee be appointed to study the matter. It was and it did, finding that a 1 ppm. tolerance was justified since other "so-called weak carcinogens" like DDT and methoxychlor are approved with 7 and 14 ppm. tolerances, respectively.

FDA accepted the committee finding for 19 agricultural commodities, but kept a zero tolerance on alfalfa and soybeans because there's no accepted data on whether dairy and other animals fed such crops would have too much Aramite in milk or meat.

Not out, but in deeper

Four newly-completed expansions and three more now on the docket effectively refute a published, but apparently unfounded, report* that National Distillers' diversification into chemicals has gone "awry."

First of the upcoming moves will involve USI Isosebacic acid (Chementator, June 1955), now being produced in the firm's just-built, $500,000 pilot plant building at Cincinnati. Detailed engineering on a commercial plant is underway, with Tuscola, Ill., or Ashtabula, Ohio, likely sites.

National's USI division is also well along on plans to expand it's position in fertilizers by making phosphoric acid. And it has another big project in mind, but is keeping this one well under its corporate hat for now. A trade guess is production of butadiene (raw material for Isosebacic) at Tuscola.

Already completed by its National Petro-Chemical subsidiary is an ethylene expansion at Tuscola hiking nominal capacity from 300 to 350 tons/day.

Also, USI has just added a Girdler natural gas reforming unit at Tuscola to supply supplemental hydrogen so that its 150 tons/day ammonia plant there can operate full blast. Before, all hydrogen had to come from National Pet's ethylene plant and there wasn't enough for full ammonia production.

And in early October, USI put two new alcohol denaturing plants onstream, one at Tuscola, the other at Newark, N. J. Able to handle 20 million gal./yr. between them, these plants feature automatic blending by remote control to meet the growing demand for rapid service.

New way to feed-grade phosphate

Use of western phosphate rock will get a welcome boost if a Bureau of Mines "neutral defluorination process" proves out. Developed at Albany, Ore., it yields a tricalcium phosphate (40-42% P_2O_5) so low in fluorine (0.17%) that it's good for both stock feeds and fertilizer, plus synthetic cryolite coproduct. And no excess acid is needed.

Fully pilot-planted, the process now awaits economic evaluation.

Ground phosphate rock is beneficiated to give a slime product (15%) and a sand product (85%). The slime contains most of the silica, vanadium and other impurities, but enough P_2O_5 to make it a useable phosphorus furnace charge. The sand, high in P_2O_5 (35%), also contains 3.4% fluorine, most of that originally present. Other major sand constituents are 52% CaO and 2.4% SiO_2.

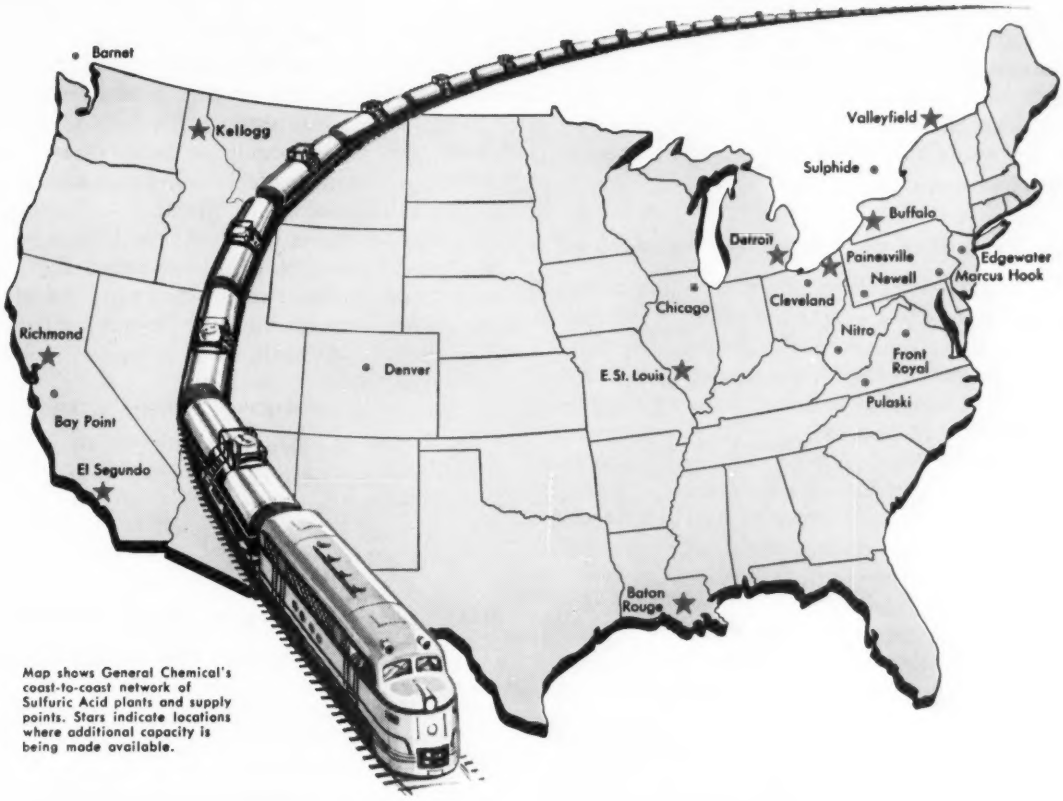
The sand is acidified with just enough 75% white phosphoric acid (relatively cheap in the Northwest) to convert calcium to tricalcium phosphate, then is calcined in a rotary kiln at 2,930 F. A water atmosphere removes nearly all fluorine and converts the tricalcium phosphate to its alpha form, highly soluble in neutral ammonium citrate. Theory is that the rock is best defluorinated when the calciner charge contains enough acid constituents (P_2O_5 and SiO_2) so that all CaO is combined as $3CaO\text{-}P_2O_5$ or $CaSiO_3$.

Scrubbing released fluorine with sodium bicarbonate converts it to sodium fluoride which is reacted with sodium aluminate and CO_2 to produce synthetic cryolite. However, though natural cryolite supplies are dwindling, any cryolite made by this new process must compete with present

(Continued on page 112)

* *Fortune*, Sept. 1955, p. 94.

An 80-Mile Train of New Sulfuric Acid Production!



Map shows General Chemical's coast-to-coast network of Sulfuric Acid plants and supply points. Stars indicate locations where additional capacity is being made available.

General Chemical Expands Capacity from Coast to Coast!

In an expansion that extends to all points of the compass, General Chemical is providing an additional 600,000 tons of Sulfuric Acid annually, with increased production facilities . . .

- ★ **West** at El Segundo and Richmond, Calif.
- ★ **South** at Baton Rouge, La.
- ★ **North** at Valleyfield, Que.*
- ★ **East** at Buffalo, New York
- ★ **In the Mid-west** at Detroit, Mich., Painesville, Ohio and E. St. Louis, Ill.

This means approximately 12,000 more tank cars of Sulfuric Acid available to meet growing requirements of industry . . . a train load 80 miles long! Some of these new facilities are already in production, and the others are scheduled for completion in 1956.

As America's foremost producer of Sulfuric Acid, General Chemical recognizes a responsibility to keep pace with industry's need for this vital basic chemical. No matter where you are located, you are within a short, low-cost haul of a primary producing center of General Chemical Sulfuric Acid. Remember . . . in emergencies and at all times . . . General Chemical is your dependable source of Sulfuric.

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sources. Even on a basis of 100 tons/day of rock, only about 3 tons of fluorine would be recovered and unit costs of converting it to cryolite might be rather high.

Probable commercial costs have not been determined, mostly because the pilot plant is too small for reliable estimates to be made. At current prices, however, the sand fraction of each ton of rock would yield about $60 worth of feed-grade phosphate and cryolite.

To try better chrome-winning method

A new chrome extraction plant, using an improved process, yet untried, is taking shape near Bandon, Ore. Mineral Sands Co., Lansing, Mich., owner of the venture, hopes to be making 200 tons/day of high grade chromite from ore-sands by the early part of next year.

The new plant (rumored to cost $3 million) will use a new Battelle Institute version of a process originally used in a wartime plant—abandoned when the high iron content of the sands prevented economical operation in peacetime.

Main improvement involves an acid leach that cuts iron content. Ore—up to 10% chromite—comes from Mineral Sands' leases in the heart of the ore-sand deposits. It's concentrated in a Humphrey spiral gravity concentrator, sent through an electromagnetic separator, then roasted and acid leached simultaneously.

Product is a high grade chromite that can be converted to chromium oxide, ferrochrome or other chrome chemicals. Mineral Sands also hopes to recover some gold and platinum known to be in the ore sands. Whether it'll be able to get enough to be worth the effort is a gamble.

The company is also taking a gamble, or as it prefers "a calculated risk," on the chromite process by moving from lab to commercial-scale operation without pilot planting. It feels that building a pilot plant would cost almost as much as the full-size facility.

Lowering a bar to nuclear progress

Almost concurrent with an Atomic Energy Commission announcement inviting proposals for small-scale—5,000 to 40,000 kw.—atomic power plants, comes the news that for the first time a commercial insurance company has underwritten hazards arising from the operation of a nuclear reactor.

The company, Indemnity Insurance of North America, wrote a package policy for Electric Boat of Groton, Conn., covering the reactor then being installed in the submarine Nautilus. The insurance went into effect just before the reactor became "critical" last January.

Similar coverage is provided on the Seawolf, sister-sub of the Nautilus, now abuilding.

Difficulty in getting adequate insurance on nuclear plants continues to be a problem, however. Absence of actuarial data on the risks to be assumed, and on the extent of liabilities and loss potentials, is complicated by a lack of standardization in reactors and reactor systems.

After a recent survey of AEC facilities, a group of top-level insurance executives agreed that the most serious problem is in "third-party liability," but getting insurance covering "business interruption" and the loss of "use and occupancy" of the facility offer added headaches.

Further study of risks continues, but support is growing for government adoption of an "atomic compensation act" analogous to current workman's compensation legislation. This law would fix damage payments to the public and peg a limit on company liability.

Dividends due from smog studies

There's a good chance that current research into the causes and cures for air pollution will pay off in many now-unanticipated ways. Today's studies of reactions taking place in the atmosphere are yielding discoveries in fundamental chemistry that may well lead to the development of processes having no relation whatsoever to the original purpose of the research. For example:

- A recent description of New York City's pollution problems revealed that over 2 million tons of sulfuric acid form yearly above the city. Though not fully understood as yet, the reaction appears to take place between SO_2, water vapor and ozone, with sunlight as catalyst.
- Various oxides of nitrogen, it's been found, gain reaction energy by absorbing sunlight. By then combining with free hydrocarbon radicals, a bewildering array of chemicals is made.

Once these reaction mechanisms are understood there's a possibility that they or similar reactions can be duplicated commercially to produce useful products.

Research now concentrates on developing instruments to detect these compounds in the air—such as Franklin Institute's ultra-long-path infrared spectrometer which proves conclusively that ozone forms in sunlight catalyzed reactions—and on tracing the routes to their formation.

For more of WHAT'S HAPPENING 114

See what you can do with the new textiles

They're weaving magic into modern textiles. Today, fabrics can be made stronger or softer, cooler or warmer, tougher or lighter, shrinkproof, mothproof, fireproof, waterproof, and almost foolproof. While it would be difficult to predict what the textiles of tomorrow will be like, one thing is certain—chemicals will make an even greater contribution to their improvement.

Working closely with textile manufacturers and finishers, Olin Mathieson offers invaluable assistance through a long-range program of *coordinated planning and production.* This assures the availability of chemical raw materials regardless of changing market conditions; assures adequate chemical production to supply growing industrial capacity; speeds the development of new chemical products and processes; provides greater flexibility in shipping and handling of materials; provides the personal attention of recognized product experts backed by widely diversified research facilities.

Currently, a growing number of chemical consumers are coordinating their planning and production with Olin Mathieson . . . America's prime producer of basic industrial chemicals. Olin Mathieson's long experience and familiarity with the broad market picture will prove invaluable in your planning. Why not consult with us *now?*

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ORGANIC CHEMICALS: Ethylene Oxide • Ethylene Glycols • Polyethylene Glycols • Glycol Ether Solvents • Ethylene Dichloride • Dichloroethylether Formaldehyde • Methanol • Sodium Methylate • Hexamine • Ethylene Diamine • Polyamines • Ethanolamines • Trichlorophenol • Trichlorobenzene

NOVEMBER
1955

What's Happening

SITE of Ketona Chemical's new ammonia plant is favorably located with respect to supplies of gas and cooling water.

Why Ammonia From Coke-Oven Gas?

With natural gas taking over as premium fuel in the Birmingham area, surplus coke-oven gas provides low-cost hydrogen for new ammonia plant.

The Southeast's huge nitrogen markets will soon be drawing on a brand-new source of supply—Ketona Chemical Corp.'s plant near Birmingham, Ala., which will start operations shortly. It is the first commercial ammonia plant east of the Mississippi's banks and south of Virginia.

The new plant is designed to make 135 tons per day of ammonia. Part of this output will be converted to 120 tons per day of nitrogen solutions in nitric acid-ammonium nitrate facilities still under construction.

Ketona's plant will be the first outside Europe to base its entire ammonia production on coke-oven gas.* The gas will come from nearby coke ovens of Alabama By-Products Corp., joint owner with Hercules Powder Co. of Ketona Chemical.

*U.S. Steel's ammonia-ex-COG plant at Geneva, Utah, is now going up.

▶ **Credit Natural Gas**—The coming of natural gas to Birmingham played an important role in the development of the Ketona project.

With natural gas taking a large share of the local premium-fuel market away from coke-oven gas,

in Chemical Engineering

coke oven operators looked into new uses for their surplus gas. They were faced with steadily rising production costs of merchant coke and were determined to improve the economy of coal.

A potential outlet was to make ammonia from the hydrogen content of COG—usually around 50-55%. One Birmingham firm, Woodward Iron Co., got a certificate of necessity for building an ammonia plant but later abandoned the idea, leaving to Ketona the distinction of pioneering this technology in the U. S.

▶ **Favorable Economics** – Actually, very few technical innovations are involved. Ammonia has been made from coke-oven gas in a large number of European plants for many years.

However, as explained by H. J. Weiland, chemical engineer largely responsible for promoting the Ketona project, process economics make the venture attractive. Ketona will be capitalizing on the free hydrogen content of COG and upgrading the remaining gas constituents to a high-grade fuel, as described below, to utilize to a greater advantage a byproduct of the coal and steel industry.

▶ **Process Highlights** – Operations at Ketona will include these conventional steps:

• Gas from ABC's ovens passes through the standard purification process, which includes electrostatic precipitation for tar removal and a final wash with a soda ash solution for reduction of sulfide content. It's then pumped through 10,000 ft of 16-in. mechanical-joint cast iron pipe to the Ketona plant.

• After being compressed from 15 psig. to 300 psig., the gas goes through a "hot bottle" (to remove gum-forming constituents), then is scrubbed in turn with straw oil (to remove aromatics), ammonia solution (to remove CO_2 and sulfur compounds), cold water (to recover vaporized ammonia) and caustic soda (for safeguard against CO_2).

• Low-temperature separation, including washing with liquid nitrogen, yields a synthesis gas consisting of pure hydrogen and nitrogen. (Liquid nitrogen comes from an air separation unit.)

• Synthesis gas is converted into ammonia in a Claude-process unit operating at 9,000 psig.

▶ **Gas Is Upgraded**—But this is not the end of the line. Components of the gas rejected by the low-temperature purification unit will be recovered and returned to ABC in two 8-in. lines.

As a fuel gas, COG has the disadvantages of relatively low Btu. value, saturation with water vapor and enough tars, naphthalene, sulfur compounds and cyanides to cause troubles in distribution lines and combustion equipment. The LTS unit will yield bone-dry, high-Btu. fractions containing none of the troublesome impurities. ABC will use these gases for coke oven underfiring or boiler fuel, or will blend them to the equivalent of natural gas heating value and sell them for injection into the natural gas distribution system.

▶ **Cool, Clear Water** – One deficiency of the Birmingham area for chemical process operations is in cooling water supplies. In selecting a plant site Ketona Chemical Corp. found a neat solution to the water problem.

Plant property includes two abandoned limestone quarries formerly operated by a steel manufacturer. The quarries are full of water, fed from springs; estimated holdup is 1 billion gal., with 31 acres of surface.

Ketona has joined the two quarries with a siphon arrangement, taking advantage of a 4½-ft. difference in water levels. Plant water supply is pulled from near the bottom of the lower quarry at a temperature of about 50 F. Warm water is returned to the far end of the upper quarry. No cooling towers are needed, and condenser efficiencies are high.

▶ **Only the Beginning?**—Ketona's "Hank" Weiland, who has been studying the potential of a chemical industry based on coke-oven gas for more than five years, predicts a bright future for the Birmingham area.

There is more coke-oven gas available to Ketona for future expansion, and removing the hydrogen consumes only one-third of the heating value while cutting the volume in half. Just as exciting are the possibilities of making other

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chemicals from the methane, ethane and ethylene streams rejected from the ammonia operation, especially in view of the fact that high-purity byproduct oxygen will be available from the air-separation step, not to mention the well known organic chemical byproducts of the coking process.

Weiland visualizes a chemical complex producing ethylene oxide, acrylonitrile, methanol, styrene and many other industrial and fine organic chemicals. While not yet posing a major threat to petrochemicals, COG chemicals may bear watching as future developments unfold.

High-Octane Gasoline Plant Set for Beaumont

Though construction probably won't start until next year, engineering is under way on a new $24 million refinery near Beaumont, Tex. A new company, Aviation Fuels, Inc., of Beaumont, will run the plant and main output will be high-octane gasoline. Part of the cost is covered by a fast tax writeoff certificate.

Government May Keep A Finger in Rubber

Now pondering the question of whether basic research in rubber needs government subsidy is a special 11-member commission authorized by Congress and set up by the National Science Foundation. Deadline for the commission's proposals to NSF is Dec. 31, 1955.

The problem is this: Since 1950 alone, the government has spent $27 million looking for improved synthetic rubber. Now that the rubber industry is in private hands it seems logical that research would also be left to commercial firms. But some government officials are worried that industry won't take up the research challenge except for products with good profit potentials, such as the recent development by Goodrich-Gulf and Firestone of synthetic rubbers that duplicate natural rubber. Some specialty, tiny-volume products might go by default.

Most rubber companies, however, say they're quite sure that competition will keep them right up to snuff in research and that they can and will do a better development job than the government could.

So the commission's job is to determine the best way of assuring that the right kind and amount of rubber research will be carried out, keeping in the forefront the desirability of freeing the U. S. from dependence on foreign-grown natural rubber. Included in the task is deciding what to do with the government's $2 million laboratory and pilot plant at the University of Akron. Possibilities include sale to the highest bidder, sale or lease to a nonprofit organization and retention and operation by the government.

More Carbon Black For Automotive Users

New facilities at the Witco-Continental plant at Eunice, N. M., will produce 25 million lb./yr. of SRF carbon black, a 10% increase in the nation's total SRF output. Bulk of the new production is for the automotive industry. SRF (semi-reinforcing, furnace) black is used in rubber mechanical goods such as windshield gaskets, mats, grommets and bushings.

Availability of plentiful supplies of natural gas dictated location of the SRF facilities at Eunice, already the site of a Witco-Continental channel black plant. To go on stream early in 1956, the plant will be operated by Continental Carbon Co.; sales are handled by its affiliate, Witco Chemical Co.

Looking High and Low For Polyethylene

There's no apparent slackening in the torrent of new polyethylene developments. Very recently four more companies revealed new plants or processes. And these despite continuing forecasts of severe excess capacity probably through 1960.

Here are the latest moves:

• W. R. Grace has licensed Phillips Petroleum's low-pressure polyethylene process (*Chem. Eng., June 1955, p. 103*) and will build an $18 million plant at a still-unannounced site. Expected, as from all the new low-pressure techniques, is a material that's tougher and higher-melting than today's commercial polyethylene.

• Dow Chemical's new 25-million-lb./yr. high-pressure polyethylene plant at Freeport, Tex., has just gone into full commercial operation. And covering all angles, Dow officials recently revealed that "we have a license under the Ziegler process (*Chem. Eng., April 1955, p. 103*) and are evaluating the new low-pressure type of polyethylene."

• There's lots of activity overseas, too. Montecatini of Italy is reported to have a new low-pressure method that gives polyethylene with a molecular weight from 100,000 to 500,000 (compared with 20-25,000 for normal high-pressure material). And in Great Britain, Union Carbide Ltd. plans to build a 26-million-lb./yr. polyethylene plant at Grangemouth, Scotland. No process has been named, but plant cost will top $12 million. Until now, the sole United Kingdom producer of polyethylene has been Imperial Chemical Industries, whose high-pressure process is the only process used commercially in the United States.

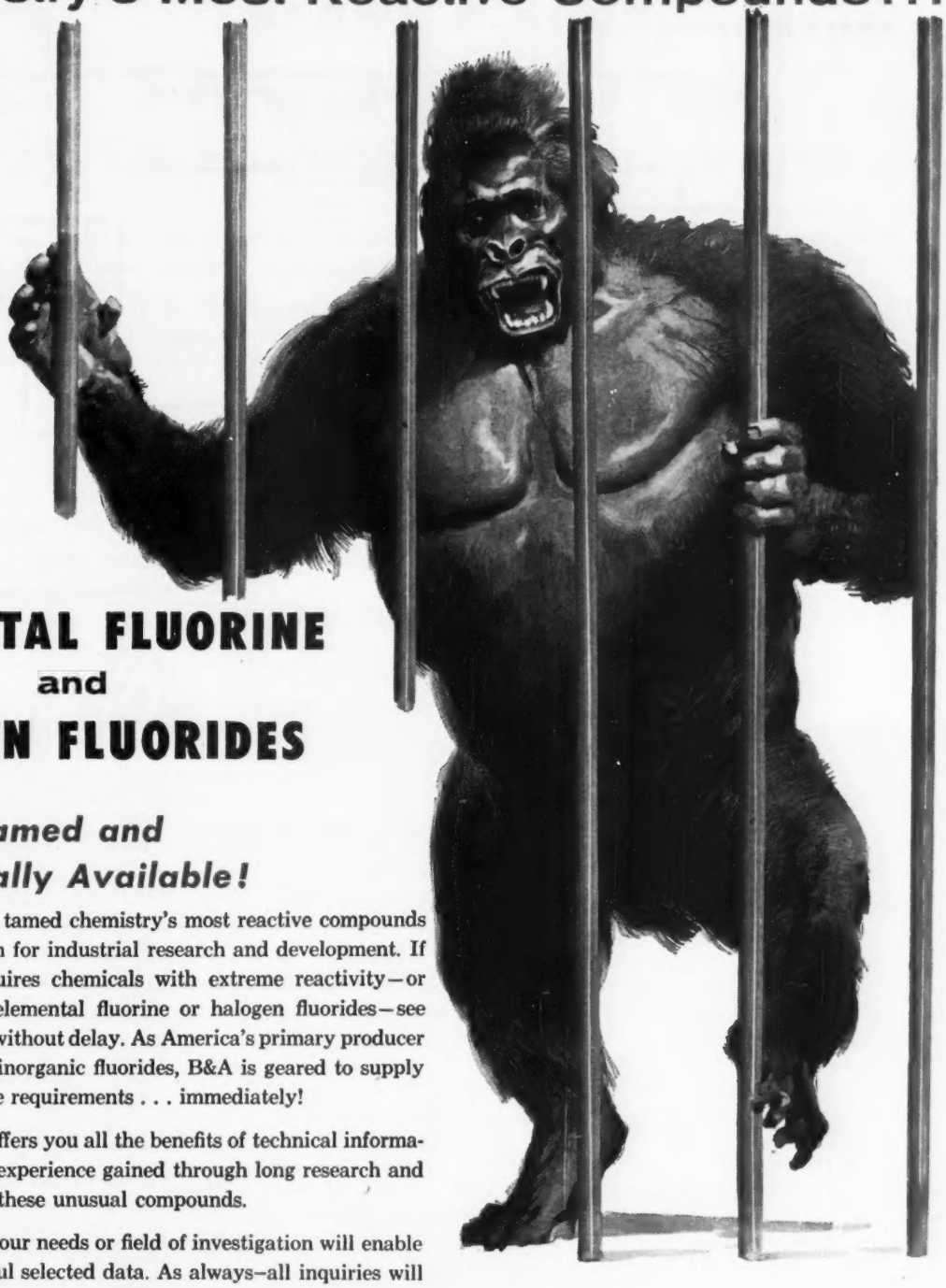
Incidentally, the basic I.C.I. patent for this technique runs out next February.

Southeast to Get More Chlorine-Caustic

Solvay Process Div. of Allied Chemical will build a mercury cell plant near Brunswick, Ga., with a capacity of 100 tons of chlorine and 125 tons of caustic soda per day.

To be completed by December 1956, the plant will eventually have an output worth over $4 million in annual sales. Electric power will come from Georgia Power Co.

Chemistry's Most Reactive Compounds . . .



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Now . . . B&A has tamed chemistry's most reactive compounds . . . harnessed them for industrial research and development. If your program requires chemicals with extreme reactivity—or directly calls for elemental fluorine or halogen fluorides—see Baker & Adamson without delay. As America's primary producer of these and other inorganic fluorides, B&A is geared to supply your entire tonnage requirements . . . immediately!

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Boiling Point	11.75°C	125.75°C	40.3°C	97°C

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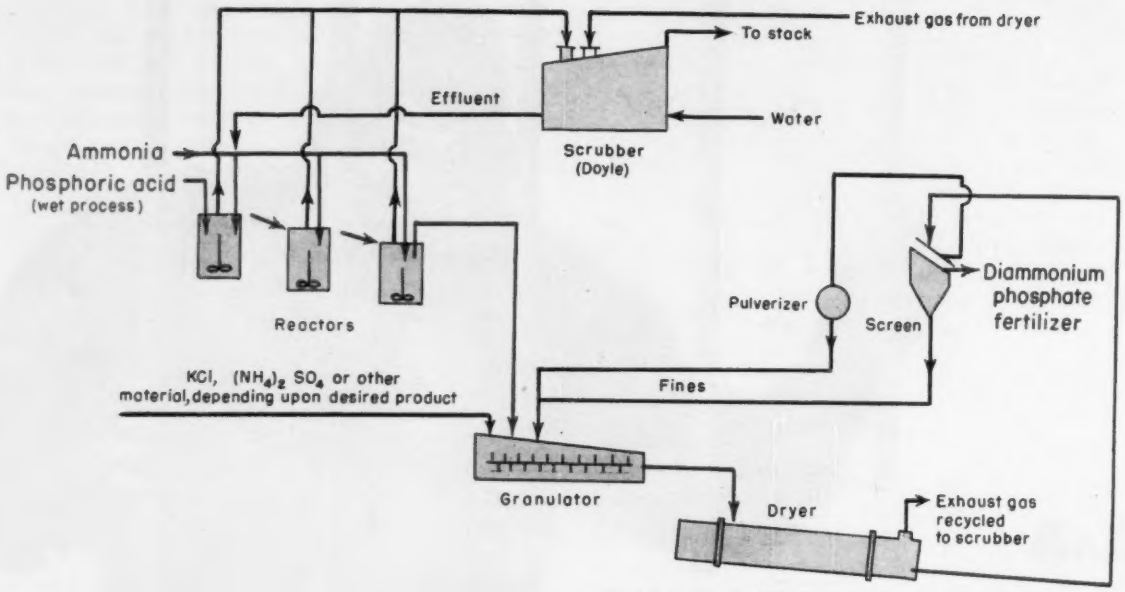

New Job for Wet-Process Phosphoric Acid

Long yearned for but spurned by diamonium phosphate producers, wet-process phosphoric acid now is used in a new $5 million DAP plant at Joplin, Mo.

Many diammonium phosphate producers have looked longingly at wet-process phosphoric acid as a cheap raw material. Most have gone no further than that—discouraged by the operating difficulties that accompany use of the acid.

But Missouri Farmers Assn., at Joplin, Mo., has taken to wet process acid as a young swain takes to his first love affair.

Backed up by some clever process engineering, MFA's new $5 million plant turns out 200 ton/day of concentrated, mixed, granular fertilizers where 80% of the P_2O_5 is present as DAP.

▶**Here's the Problem**—In growing demand now because of today's trend toward more highly concentrated fertilizers, DAP is made by a coke-oven operator (as an alternative to ammonium sulfate) and by a number of fertilizer producers. Operating at about 150 F., they all react ammonia with high-purity phosphoric acid derived from electric-furnace phosphorus. The resulting slurry, concentrated to 50% solids, is filtered (or centrifuged) and the cake dried.

Although a simple technique, it's not workable with wet-process acid made by reacting sulfuric acid with phosphate rock—iron and aluminum impurities form gummy, difficult-to-filter precipitates. This has been a deterrent to potential DAP producers unfavorably situated with respect to sources of furnace acid.

▶**Here's the Solution**—The new process, invented and engineered by Dorr-Oliver, Stamford, Conn., owes its success to a two-stage system in which monoammonium phosphate is formed first at 210 F., followed by ammoniation of the MAP to DAP (about 80% conversion) at a temperature of 212 F.

This system permits MFA to take full advantage of the heat of reaction to drive off water. No external heat is required. Slurry coming from the DAP reactor contains 80% solids, making it economical to eliminate the concentration and filtration steps entirely. The slurry goes directly to granulation and drying.

Two-stage operation helps keep ammonia losses to a minimum, despite the high operating temperature in the second stage, by tying up some ammonia as MAP. There's little loss of ammonia in making the MAP, since much lower ammonia concentrations are needed, compared to that required for DAP.

▶**Down With Ammonia Losses**—Also helping to keep ammonia losses low are two important factors responsible for getting a low ammonia partial pressure (5 mm. Hg) in the second reactor—the NH_3-phosphoric acid mole ratio in solution, and water content.

At 212 F. any mole ratio in the range of 1.5 to 2.0 will produce DAP–MAP forms below 1.5, an unstable salt above 2.0. Missouri

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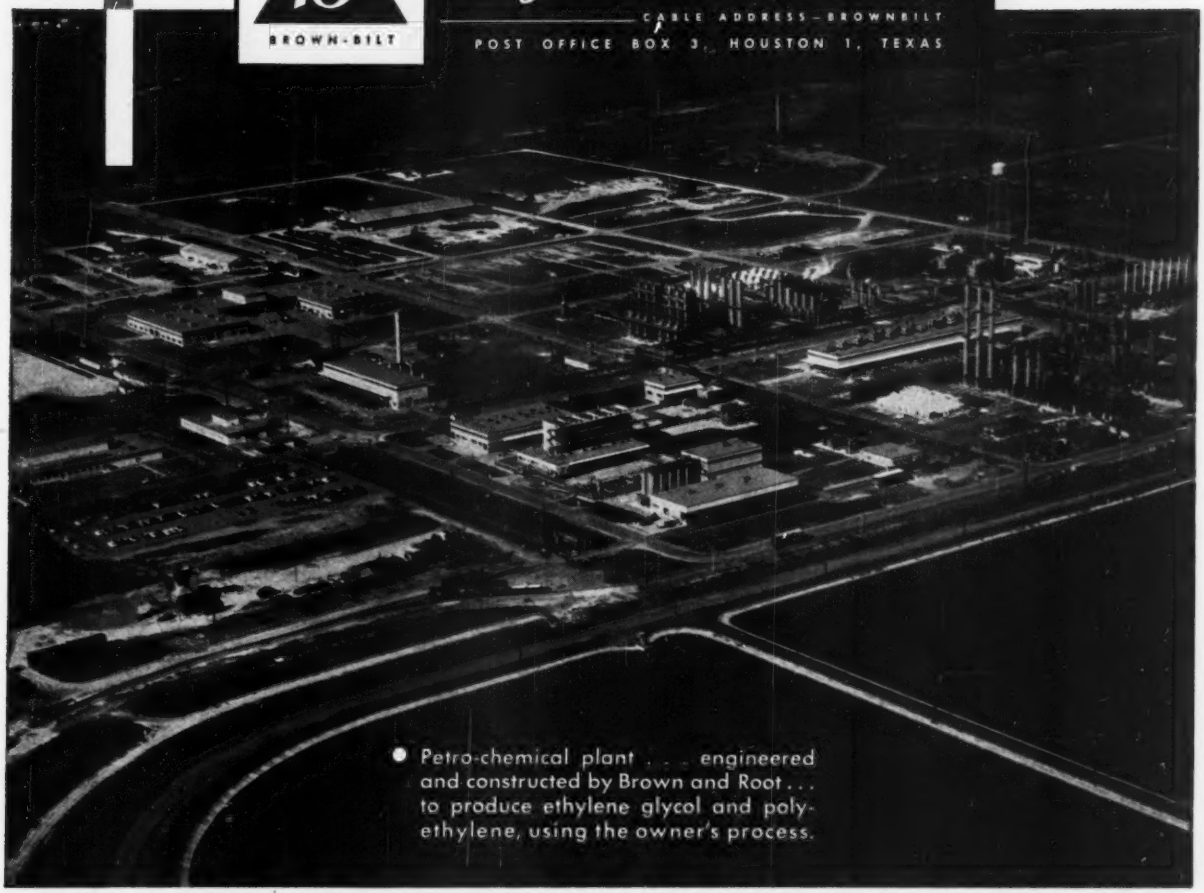

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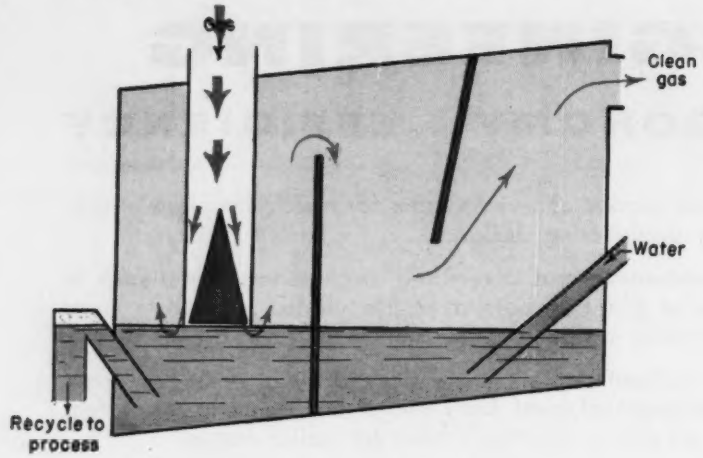


Simple and Effective Scrubber

Developed by Harold Doyle, of Consolidated Mining and Smelting Co., the Doyle scrubber is a simple, but effective device for removing solids and fumes from gas streams.

In operation, inlet gas goes through a cone-shaped throttle designed to increase gas velocity. This gas impinges on a water surface creating a dense spray, which scrubs the gas clean. A baffle arrangement then frees the gas of entrainment. Part of this water, containing solids and dissolved gases, is returned to the process.

Dorr-Oliver—who is licensed to market and fabricate the scrubber—wanted the Doyle scrubber installed at the Joplin fertilizer plant primarily because it can cheaply recover valuable material in a small volume of water.

Farmer operates at the low side of the range—1.5—where the ammonia vapor concentration is also the lowest possible. Actually, in practice, some MAP also forms at 1.5.

The low water content of 20% in the reactor slurry, while eleminating the need for a filter, has one other advantage. It tends to establish a triple-point phase condition—where the solid phase contains 80% DAP and 20% MAP—which fixes the low ammonia partial pressure.

Most of the ammonia that does come off at Joplin (about 0.8% in the steam) is recovered in an impingement scrubber, newly introduced into this country (see above sketch).

▶**How the Process Works**—A 32% P_2O_5 phosphoric acid is made at Joplin in a standard Dorrco unit by reacting sulfuric acid with Florida phosphate rock. It's filtered on traveling-pan filters, then sent to the DAP unit after evaporation to 37½% P_2O_5.

Here the ammonia-acid reaction is carried out in a series of three agitated tanks, with gravity flow from each. Reactors are made of steel, lined with lead and acid-proof brick. The first reactor is 11 ft. dia. by 11 ft. high, the other two are 8 by 10 ft. All adjustments are made in the third reactor.

Overflow slurry (20% water) from the last reactor has a solid made up of 80% di- and 20% monoammonium phosphate. On a dry basis the solid analyzes 18% nitrogen and 48% P_2O_5.

This slurry goes to a granulator (blunger)—a horizontal tank containing two horizontal shafts fitted with intergeared blades. Fines and other materials (KCl, ammonium sulfate) are added here. In some cases ammonium sulfate is formed directly in the first reactor by adding sulfuric acid with the phosphoric.

Each solid particle in the blunger receives a coating of slurry, gradually building up into larger particles. Finally, a rotary dryer removes moisture. Exhaust gases go to the scrubber. Dry material is handled on double-deck vibrating screens, where the intermediate cut is product.

▶**At TVA, Another Process**—There's another way of getting around the filtration problems introduced with wet-process acid. That's by removing the impurities in a filterable form, before the main reaction is carried out. This is exactly what TVA does in a recently announced process—not yet proved in a commercial plant.

TVA removes iron and aluminum impurities as phosphate precipitates by adding a small amount of ammonia to the acid, bringing the pH to 5. In this form the metals can be easily filtered.

The acid filtrate then reacts with ammonia in a vacuum crystallizer, forming DAP as a 50% solids slurry at 140 F. Heat of reaction helps to drive off some of the water of crystallization.

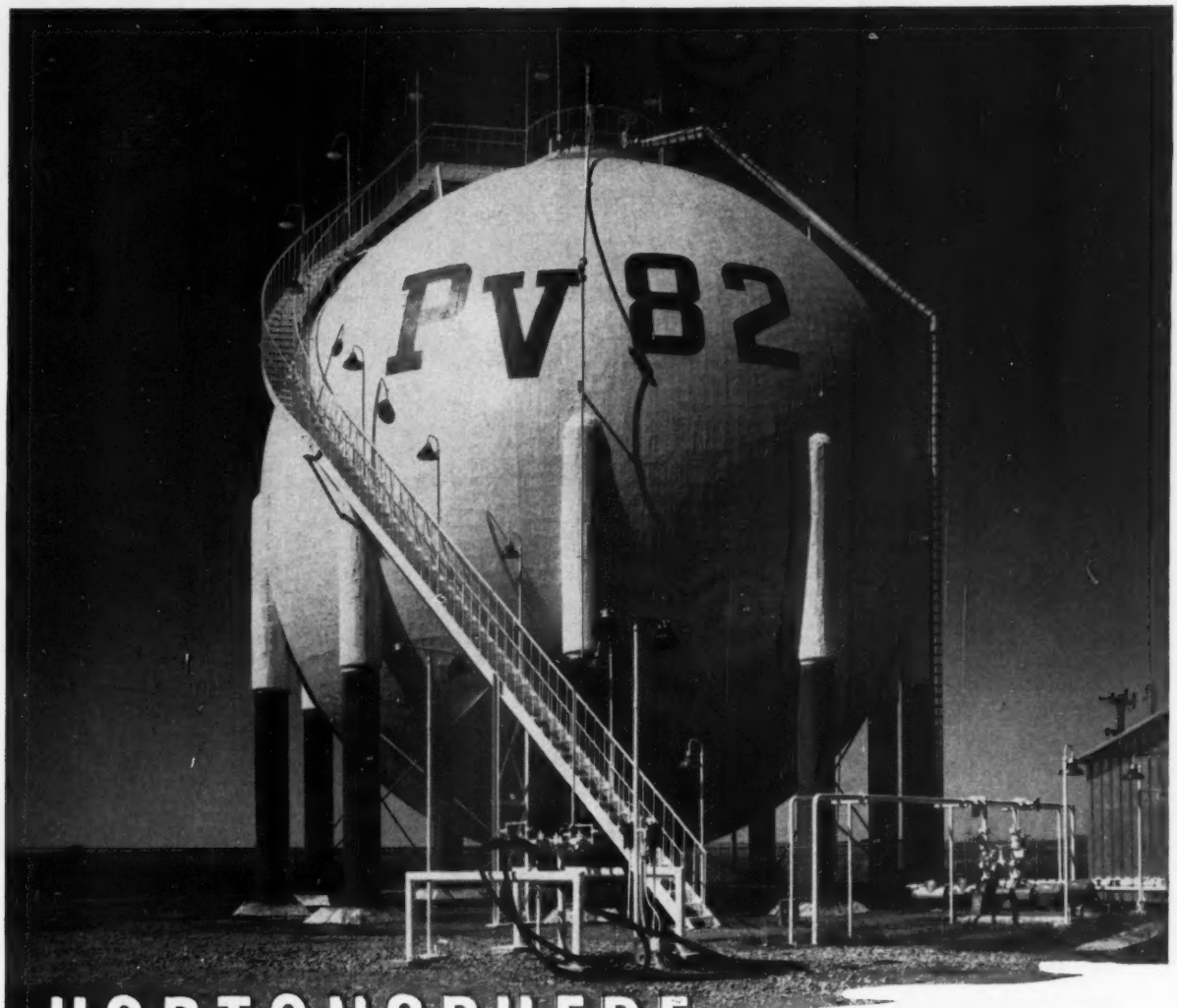
Crystals are centrifuged, mixed with the metal phosphate cake and dried. An 18% nitrogen, 47 P_2O_5 diammonium phosphate is made. But, as in the Dorrco process, other ingredients can be added to make granular, mixed fertilizer.

Help ChE Fraternity Help the Industry

To function at highest efficiency, Omega Chi Epsilon, honorary chemical engineering fraternity founded at the University of Illinois in 1931, must continue to grow at the same astounding rate as the field as a whole. And that's just what the newly elected slate of officers will stress.

Local chapters do much to stimulate interest in chemical engineering, promote scholarship, organize and direct departmental activities among undergraduate and graduate students. But they can do even more, both for the profession and for the industry, as they gain the help of all chemical engineers.

President of Omega Chi Epsilon is Kenneth A. Kobe of the University of Texas in Austin, the national headquarters.



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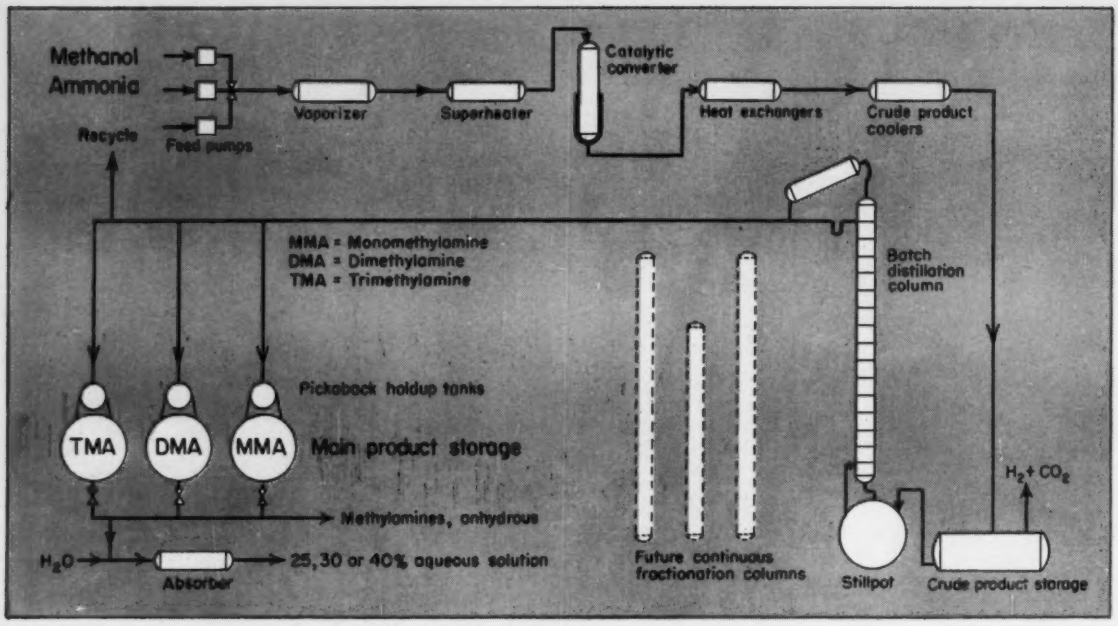


SIMPLIFIED CYCLE for making mono-, di- and trimethylamine where a . . .

Streamlined Design Disregards Old Ideas

U. S.-designed plant has many cost-cutting features that may be applied to other processes. Recycled amines processed through single system.

Departing from convention, a new methylamines plant at Yokohama uses 40% less capital investment in equipment than in comparable older plants, according to Brown, Blauvelt and Leonard, New York engineering firm that designed the Japanese plant.

Yet complete process flexibility is retained. The plant can produce mono-, di- and trimethylamines in any desired proportions by recycling unwanted product through the single catalytic converter to suppress re-formation of that product. Key to this flexibility is a special combination catalyst (two undisclosed ingredients deposited on an alumina gel base).

The new plant is operated by Nitto Chemical Co., a leading Japanese chemical manufacturer with four major plants and a capitalization of about $75 million. The methylamines unit cost $250,000. It can turn out 1,000,000 lb./yr. using the present batch distillation system; capacity can easily be expanded to triple that amount by installing additional columns for continuous distillation.

▶ **Will Help Make Fibers**–The plant synthesizes a mixture of methylamines by the reaction of ammonia and methanol at temperatures up to 475 C. and pressures above 250 psi. The basic reaction:

$$NH_3 + CH_3OH \rightarrow \begin{cases} CH_3NH_2 \\ (CH_3)_2NH \\ (CH_3)_3N \end{cases}$$

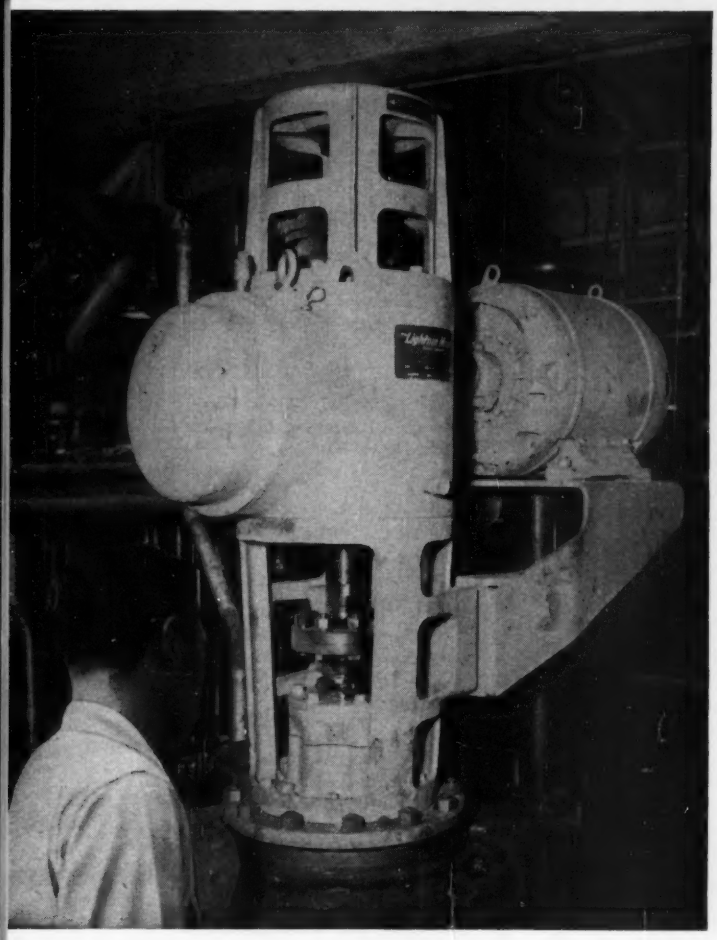
Monomethylamine, dimethylamine and trimethylamine are recovered from the reaction product by fractional distillation. Methanol is brought in by tankcar; ammonia, produced by Nitto at an adjacent plant, is delivered by pipeline.

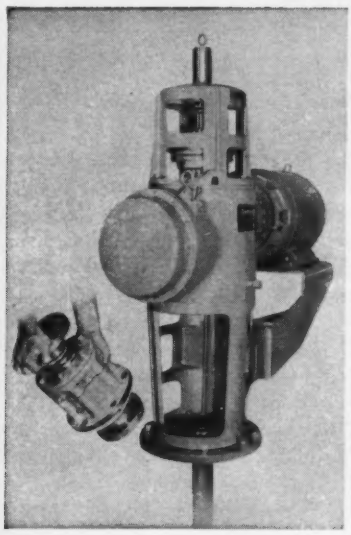
A major use for methylamines is in the production of dimethyl formamide, a solvent for acrylic fibers. Although Japan is not manufacturing acrylic fibers at the present time, its entrance into this field is imminent, according to J. D. Leonard, who supervised the methylamines project.

▶ **For Easy Maintenance**–Layoutwise the production units are noteworthy in that they are constructed at ground level to ease maintenance and repair. Usual practice has been to hang goodly portions of the processing equipment on the fractionation column supporting structures.

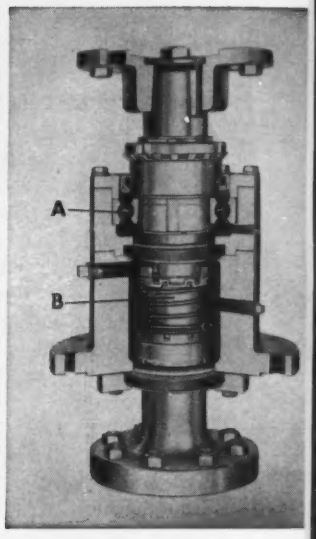
However, it has been found–particularly in Japan–that the costs of rigging, scaffolding and extra labor required for maintenance would be out of line with operating costs. This would be true both for repairs and for routine cleaning and painting as well.

▶ **Pickaback Tanks**–Unusual design thinking has also been applied to the product storage part of the plant. Before each product is dropped into its main storage tank





IF YOU CAN USE A WRENCH, you can replace a LIGHTNIN rotary seal in a few minutes. The mixer stays on the tank. Just unbolt and lift out this one-piece cartridge assembly; bolt a new one in its place; you're back in operation.



SMOOTH RUNNING. Prelubricated mixer shaft bearing (A) is part of seal assembly, close to seal for proper shaft support. But seal lubricant chamber (B) is separate from bearing—so you can choose best seal lubricant for your needs, without regard to bearing lubricant. Seal is stocked in wide range of designs and corrosion-resistant materials.

NEW LOOK in fluid mixing. This seal cartridge takes the place of a stuffing box; runs for years without adjustment; handles pressures to 1200 psig, temperatures from −120°F. to +485°F. Seals are optional equipment on LIGHTNIN top entering, side entering, and bottom entering mixers.

Newest cost-saver for fluid mixing:

End stuffing box repacking . . . forever

with a rotary seal that's easy to replace

You may get a whole new concept of the ease of mixing fluids under pressure or vacuum, when you read this story.

For here is a rotary seal that gives you leakproof, low-maintenance fluid mixing for *years,* under most conditions.

Yet *anyone can replace this seal in a few minutes,* if necessary. Without dismantling or demounting the mixer. Without draining the tank. And *without special skill.*

Here's what you gain when you specify LIGHTNIN Mixers with new LIGHTNIN Seals:

1. *You end leakage*—for good. The seal positively will not leak during its operating life. You can get standard LIGHTNIN Seal assemblies to handle pressures as high as 1200 psig; temperatures from −120°F. to +485°F. Special designs are available for more extreme conditions.

2. *You eliminate the cost* of repacking stuffing boxes. The LIGHTNIN Seal takes the place of a stuffing box. Under most conditions, it runs for *years* without changing.

3. *You stop costly "nursing"* of stuffing boxes. The seal *never* needs adjustment.

4. *You can replace* a LIGHTNIN Seal *in a few minutes,* should it ever become necessary. Only one *cartridge* component to unbolt and replace—and you're back in operation. Anyone who can handle a wrench can do it.

Already, many chemical processors are using LIGHTNIN Seals.

Users report maintenance savings running into many thousands of dollars yearly.

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In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave., Toronto 10, Ont.

it must await analysis in a small holdup tank.

In most cases these holdup tanks are supported on separate structures. However, at the Nitto plant they are mounted on top of the main storage tanks pickaback style, saving structural materials and installation costs, in addition to maintenance costs.

Although there has been reluctance to use this technique with pressure vessels, the design passed the Japanese safety codes. Leonard feels that—particularly in view of this successful application—the design will find approval in the United States.

▶**Feed Rate Control**—High-pressure piston pumps feed both raw materials to the process. The pumps are of the positive-displacement type and deliver at a constant preset rate.

However, output rate may be adjusted merely by turning a pointer on the central panelboard. Incidentally, the pumps and control instruments are the only units that are housed.

▶**Major Equipment Savings**—Ammonia, methanol and recycle liquid feed a high-pressure synthesis system consisting of vaporizer, superheater, converter, heat exchangers, product coolers and crude product receiving tank.

Nitto uses only one vaporizer and one superheater. Older plants have five vaporizers and five superheaters —separate units for each of the three methylamines and for each raw material.

The superheater and converter use electric heaters instead of high-pressure steam. This substitution accounts for major savings in equipment costs.

A single distillation column replaces the dual columns now used for batch operation in the United States. When the plant is converted to continuous operation, four bubble-plate columns will do the work that now requires seven to ten columns in the U.S.

This reduction in the required equipment effects similar reductions in process piping, wiring and utility connections. Also, instrument requirements are reduced because there are fewer pieces of equipment to control.

▶**High Yield, Purity**—Yields are better than 90% on both ammonia and methanol, and product of 96 to 99% purity can be produced as needed. In older U.S. plants the unwanted methylamines are destroyed by burning. Here they can be recycled and re-formed.

Nitto also has a single continuous absorption system where the pure amines can be packaged as 25, 30 and 40% solution in water.

One operator can easily handle this completely instrumented process. However, two men are always used for safety reasons. The plant is so designed that there are virtually no leaks, and the characteristic fishy odor which foretells your approach to a methylamine plant is missing.

▶**Growing Markets**—U.S. production of methylamines is now about 30,000,000 lb./yr. Forecast is that consumption of 90 to 100 million lb. can be expected by 1960.

In addition to the application in synthetic fiber production already mentioned, here are some other important outlets:

• Monomethylamine is used in the manufacture of synthetic ephedrine, vat dyes, Metol and tetryl.

• Dimethylamine is a raw material for rubber chemicals, thiocarbamate fungicides and various kinds of alkybenzylammonium chlorides. The sulfate salt is widely used as a dehairing agent for animal hides.

• Trimethylamine finds major application in choline, widely used in pharmaceuticals, animal feeds and nutritive agents such as methionine. Detergents is another application. And several million lb./yr. are reportedly used in making nylon salts.

With these growing markets for its products the BB&L process seems to have a bright future. According to Leonard, a plant of similar design constructed in the United States would pay for itself in about a year and a half. With continuous distillation facilities, the plant would pay off in a little over a year.

Convention Calendar

Association of Consulting Chemists and Chemical Engineers, annual meeting, "How to Buy and Sell Consulting Services," Belmont Plaza Hotel, New York, Oct. 25.

National Lubricating Grease Institute, annual meeting, Edgewater Beach Hotel, Chicago, Oct. 31-Nov. 2.

National Association of Corrosion Engineers, Northeast regional meeting, "Underground Structure Corrosion," Hotel Niagara, Niagara Falls, N. Y., Nov. 1-3.

World Symposium on Applied Solar Energy, Westward Ho Hotel, Phoenix, Ariz., Nov. 1-5.

Chemical Market Research Association and Commercial Chemical Development Association, joint meeting on synthetic fibers, Hotel Carter, Cleveland, Nov. 14-15.

National Association of Corrosion Engineers, Western regional meeting combined with an intensive course on "Corrosion Problems in the Process Industries" given in cooperation with the University of California, University Extension Building, San Francisco, Nov. 14-16.

American Petroleum Institute, annual meeting, St. Francis Hotel, San Francisco, Nov. 14-17.

Second International Automation Exposition, Navy Pier, Chicago, Nov. 14-17.

American Society of Mechanical Engineers, Exposition of Power and Mechanical Engineering, Coliseum, Chicago, Nov. 14-18.

Conference on "The A-Bomb and Industry—a Prescription for Survival," Armour Research Foundation, Illinois Institute of Technology, Chicago, Nov. 17.

American Institute of Chemical Engineers, annual meeting, Statler Hotel, Detroit, Nov. 27-30.

25th Exposition of Chemical Industries, Commercial Museum and Convention Hall, Philadelphia, Dec. 5-9.

Nuclear Engineering Congress and International Atomic Exposition, Public Auditorium, Cleveland, Dec. 10-17.

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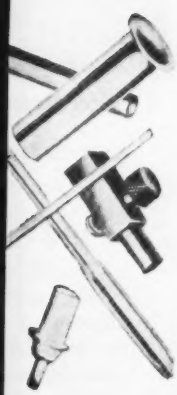

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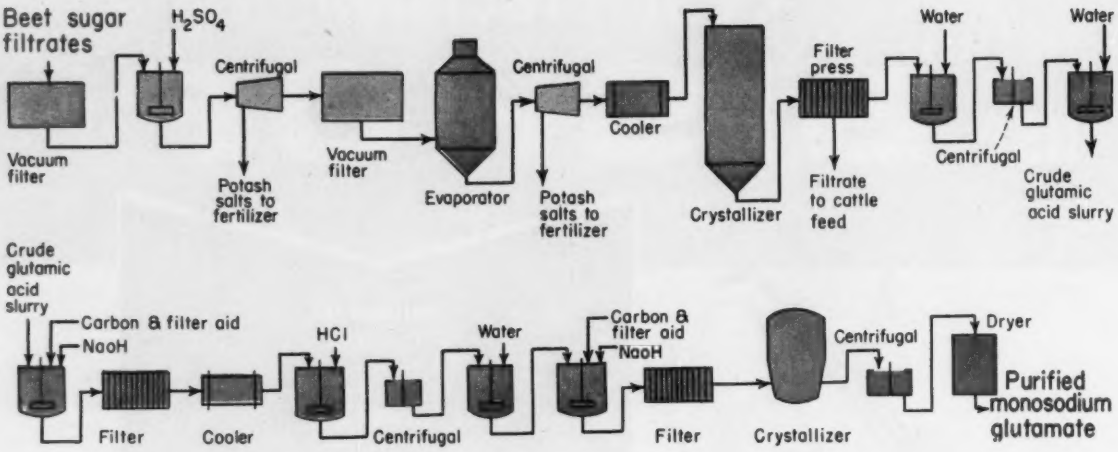

New process based on beet-sugar waste is Great Western Sugar Co.'s bid as . . .

MSG Makers Vie to Please Your Taste

Flavor-enhancing chemical reaches for big-time markets as growing output from new and expanded plants threatens to upset today's price structure.

When annual production capacity of a chemical selling for $1.55 a lb. goes over the 20 million-lb. mark, that chemical is making news. Such a product is monosodium glutamate.

Here are some of the recent developments in the fast-moving MSG picture:

• Great Western Sugar Co. put into operation late last year a new $2.5 million plant at Johnstown, Colo. Annual production may be as high as 3½ million lb., although under current legislation the availability of raw material (beet sugar byproduct) may limit production to 2¼ million lb. Great Western uses the process shown in the above flowsheet.

• Great Western's entry into the MSG business followed closely on the heels of a plant expansion by International Minerals and Chemical Corp. at San Jose, Calif. Capacity at San Jose is now placed at 8 million lb. per year.

• Just getting under way in a new plant at Montreal is Industrial Grain Products, a subsidiary of Ogilvie Flour Mills. MSG capacity is about 1 million lb. per year.

Also on the scene are three other U. S. producers – Huron Milling, A. E. Staley and General Mills – plus a smaller, older International Minerals plant and a small Canadian producer, H. L. Blatchford Ltd. Combined annual capacity of these plants is estimated at about 10 million lb.

▶**Price Cut Due?**–Today's MSG picture is not entirely a pleasing one. Capacity to produce has grown faster than consumption. Result: A highly competitive situation, which ordinarily might suggest a cut in selling price. An economic study by Aries and Copulsky in 1949 (*Chem. Eng.*, Dec. 1949, p. 285) suggested an eventual bulk price of $1 per lb.

Moreover, according to a price-production study of industrial chemicals by S. C. Schuman (*Chem. Eng.*, Mar. 1955, pp. 180-2), the average price of a chemical made in quantities of 20 million lb. per year is around 20-25¢ per lb., with very few prices exceeding 50¢.

On the other hand, MSG production facilities aren't cheap. According to the figures on cost and capacity for Great Western's plant, fixed investment is about 72¢ per annual lb. International's San Jose plant is worth about the same.* Since producers of fine chemicals historically show an average turnover ratio of about 2 to 1, today's $1.55 price tag doesn't seem out of line.

▶**Pass the MSG**–Accounting for the spectacular rise of monosodium glutamate is its ability to–literally –please the public's taste.

MSG is used by commercial food processors and housewives alike to enhance the flavor of meats, seafoods, soups, even cooked vegetables. Although pure MSG has only a sweet, saline taste, its effect on food flavor is due, according to International Minerals, to "blend-

*International's initial investment at San Jose in 1947 was about $3 million, and the expansion in 1953 cost another $1.5 million. In terms of today's construction costs, the plant represents an investment of at least $6 million, or 75¢ per annual lb. of capacity.

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TOTE* SYSTEM now offers the NEW, TESTED Container Car

Permits rail shipments of bulk materials without freight costs on forwarding and return of Tote Containers.

This car was recently introduced by Shippers Car Line Corporation of New York City and Tote System, Inc. Twenty-eight Tote containers are securely shored in place on the car. Upon arrival at destination, the shoring bars swing easily out of place for unloading. One man can completely unload the car in 35 minutes using a battery powered walkie-type lift truck.

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Tote System SAVES time and labor . . . container costs . . . losses due to contamination and deterioration . . . losses due to breakage, spillage and sifting . . . losses due to rodents, insects and weather. Tote System also SAVES investment in expensive fixed storage and conveying equipment. Its flexibility and adaptability to changes in plant layout are unmatched.

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It is possible to make long haul shipments of bulk materials in unit containers without any freight costs on the containers themselves . . . to make mixed or split shipments of various bulk materials . . .

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CENTRIFUGING of crystals is typical operation in MSG production.

ing and rounding out without itself contributing any noticeable odor or taste." This effect is pronounced in concentrations of 0.1 to 0.3%.

▶**How It's Made**–Principal starting materials for manufacture of monosodium glutamate are corn or wheat gluten or beet-sugar waste. Glutamic acid is produced by hydrolysis of the glutamine in the raw material, isolated by concentration and crystallization, then converted to the monosodium salt and purified.

International Minerals at San Jose and Great Western both start with beet-sugar waste; the other producers use gluten. However, Great Western's operations differ in some respects from the previously published description of International's (*Chem. Eng.*, Apr. 1948, pp. 100-1, 136-9).

One difference is in the raw material. International uses what is known as Steffens waste, the filtrate discarded when sugar is precipitated from beet molasses by lime as calcium saccharate.

At its Johnstown sugar refinery, however, Great Western uses barium hydroxide as the precipitating agent–the only U. S. refinery to use this process. The filtrate from this process, which GW appropriately calls "Johnstown filtrate," provides the bulk of the starting material for making MSG. It is supplemented by Steffens filtrate shipped in from five other Great Western factories.

Another difference is in the hydrolyzing agent. Whereas International uses caustic soda, Great Western uses sulfuric acid. In this way GW recovers potassium from the filtrate directly as the slightly soluble sulfate. International gets the potassium out in another step by converting it to the chloride, which is somewhat more soluble than the sulfate.

▶**Process Highlights**–Here is a brief description of Great Western's process:

The two kinds of concentrated filtrates are weighed and blended in a mixing tank, clarified in a rotary vacuum precoat filter, then hydrolyzed by the addition of concentrated H_2SO_4 in a series of three mixing tanks. Flow of acid is controlled to give a pH of 3.2.

Potassium sulfate formed during acidification is removed in a continuous centrifugal. The separated salts are slurried in water, refiltered in another continuous centrifugal and dried in a rotary dryer.

Filtrates are further clarified in another precoat filter, then concentrated to about 70% solids in a continuous single-effect evaporator. During evaporation a second crop of K_2SO_4 crystals forms. It is separated in a continuous centrifugal and processed with the first crop.

The concentrated filtrate is cooled and pumped to large crystallizing vessels, where it is held for about five days. During this period crude glutamic acid slowly crystallizes.

Crude acid is removed in plate-and-frame filter presses. Filtrate is neutralized with gaseous ammonia to yield a cattle feed known as LPC (liquid protein concentrate).

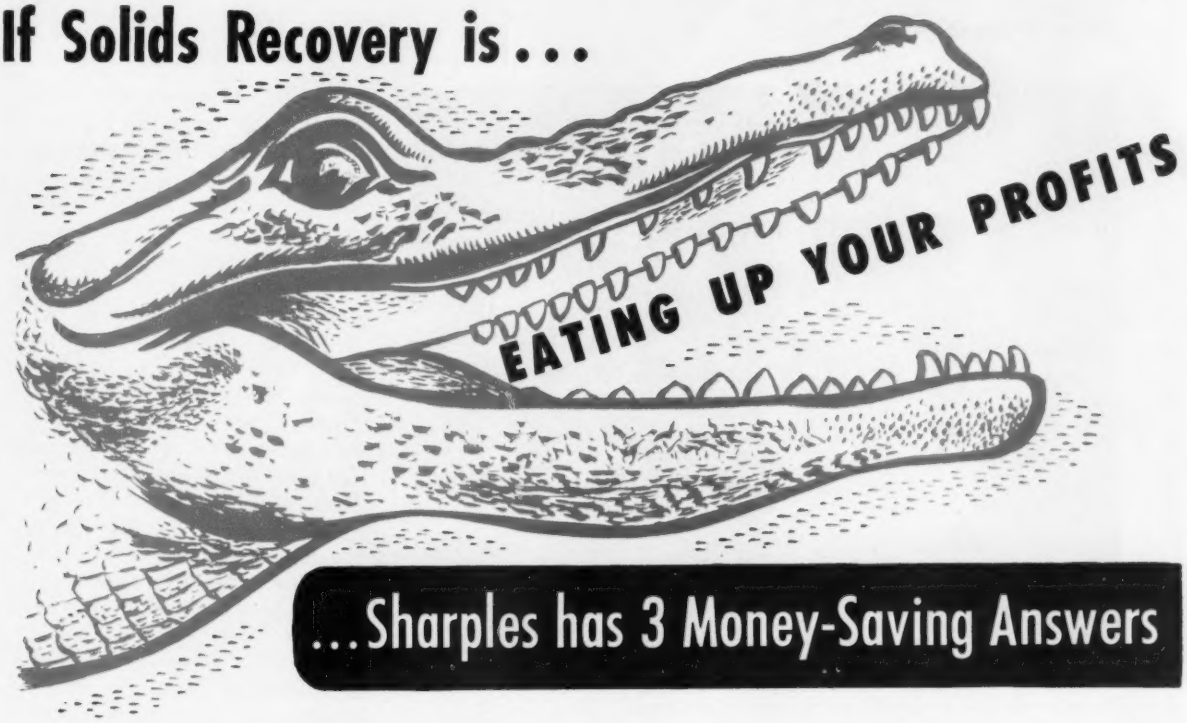
Crude glutamic crystals are reslurried, water-washed in batch centrifugals, then dissolved in water and NaOH as MSG. This solution of crude MSG is treated with vegetable carbon and filtered, then passed through a series of tanks to which HCl is added to reprecipitate purified glutamic acid.

Glutamic acid is separated in centrifugals and again dissolved in water and NaOH. The MSG solution is finally treated with carbon, filtered, evaporated to crystals, centrifuged, dried and packaged.

▶**Process Development**–Great Western began preliminary research on MSG in 1943, installing a small pilot plant at the Longmont, Colo., factory. This unit was expanded two years later. A larger-scale plant was integrated in the Loveland, Colo., factory in 1950. Successful operation led to the new commercial plant at Johnstown.

Economics of Great Western's MSG production is enhanced by the recovery of potassium salts for fertilizer and the production of the livestock feed, LPC. The MSG plant, according to President Frank A. Kemp, exemplifies Great Western's long-standing policy of making fullest use of sugar-beet by-products.

If Solids Recovery is . . .



. . . Sharples has 3 Money-Saving Answers

Whether your problem is to recover an extremely small quantity of solids from a liquid . . . produce tons of dry crystals per hour continuously . . . rough out solids as a process step . . . or remove all undesirable solids from a slurry—there is a type of Sharples centrifuge to do the job continuously, and at low cost.

Only Sharples gives you the advantage of approaching your problem with the three basic centrifuge types (disc, scroll and basket) from which to choose—

The Heavy Duty DH-3 Concentrator.

The New High Speed Sharples Super-D-Cantor.

The High Capacity Sharples Super-D-Hydrator.

Sharples is able to recommend, without bias, the best centrifuge for your solids recovery problem because we make all of the basic types, and have long experience with them.

We'll be glad to send you a copy of Bulletin 1259 which describes the complete line of Sharples Centrifuges.

A PROVING GROUND FOR BETTER PROCESSING

Sharples maintains a completely equipped centrifugal test laboratory for industry. Any of the nine basic types of Sharples centrifuges can be applied to your problems under conditions which closely parallel plant operating conditions. You are invited to make use of these exceptional facilities.

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To keep pace with new high-strength materials, engineers . . .

Seek New Pressure Codes

If you spend more for engineering, you can reduce the over-all cost of pressure piping and vessels. This is basis for proposed code revisions.

General acceptance of increased engineering costs as a means of reducing over-all costs justified the extension of allowable stress range in the ASA Code for Pressure Piping (1953). Allowable stress range for expansion effects was increased in proportion to the degree of control exercised in design details.

Now, voicing opinions that have been expressed by many other vessel designers, engineers of the M. W. Kellogg Co., New York, are proposing that we reexamine the ASME Code for Unfired Pressure Vessels using this same philosophy.*

Most significant of the proposed changes would establish a new class of pressure vessel, specially designed and carefully fabricated, for which a safety factor equal to 3 would be acceptable.

The ASME Boiler and Pressure Vessel Codes, which most engineers use for pressure-vessel design, have been aimed primarily at the needs of shop inspectors and government enforcement agencies. Although the codes have been extensively modified and expanded over recent years in an effort to provide for the needs of our rapidly expanding technology, we appear to be on the threshold of a new era.

► **Why a Change Now?**—We now have new alloy steels of high strength, improved corrosion resistance and, unfortunately, lesser ductility. However, since we may be willing in many cases to be more precise in our attention to design details, the Kellogg engineers propose that the rules ought to be more flexible and better balanced.

As a first step they propose a realignment of responsibilities. Under the present codes, the manufacturer and the shop inspector share the responsibility for code compliance through the issuance of signed data reports and their stamps of approval on the completed vessel.

The Kellogg proposal would extend the area of responsibility to include, in addition, the user of the vessel and the vessel designer. Here's what each would be responsible for:

• **The user of the vessel** should select the material of construction and its protective coating to limit corrosion, deterioration and impairment by the contents. Also, the user should be responsible for the maintenance and operation of the vessel, establishing safe operating requirements (such as temperature, pressure and cycles) that will be provided for in the design.

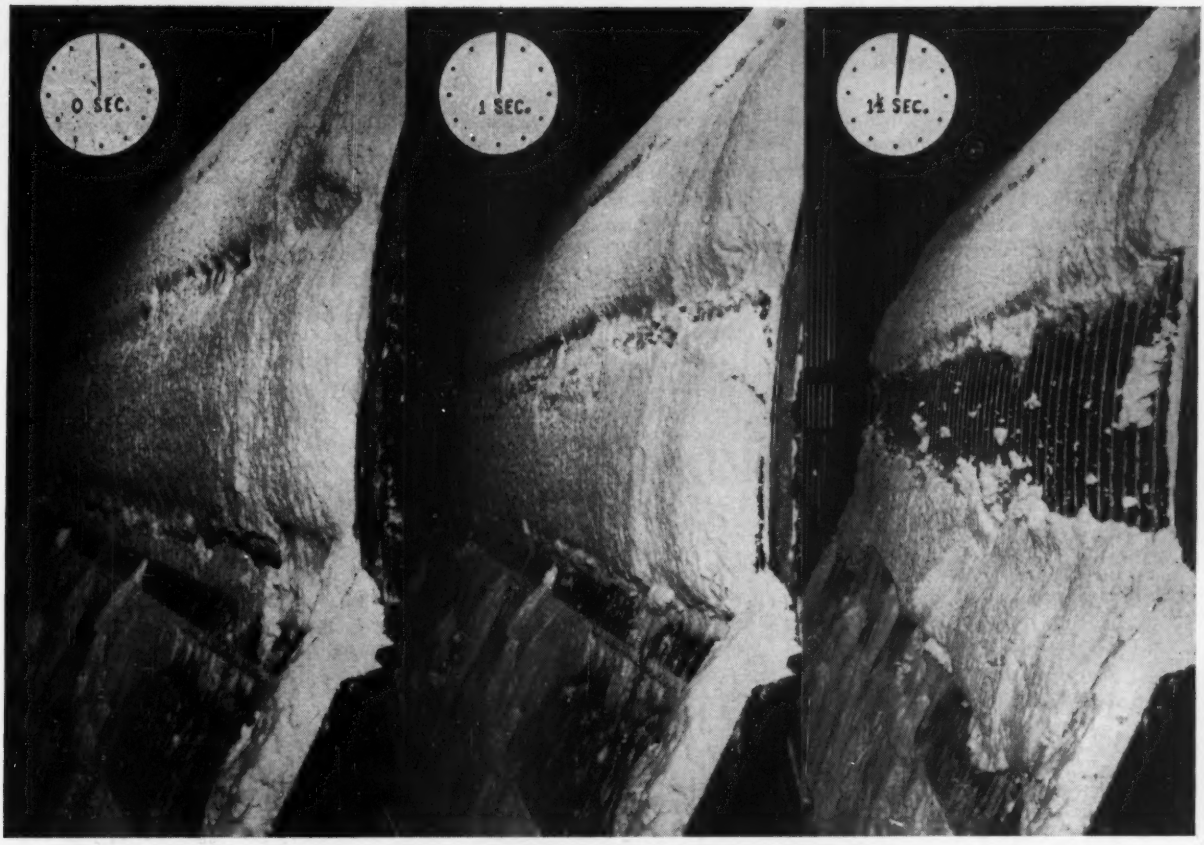
• **The vessel designer** would establish the design requirements; select the vessel class and detailed requirements; and perform the specialized calculations. He would then approve the detailed design by formally signing the data reports and attaching approved drawings.

• **The vessel fabricator** would then be responsible for working out the detailed design to conform to the requirements set by the vessel designer and for fabricating the vessel to the approved design. The fabricator would also share in the responsibility with the supplier for materials used according to specification and without defects.

• **A qualified inspector** and the fabricator would both inspect the vessel, as a last step, and stamp it as matching the approved design drawings and meeting the code.

► **No Sacrifice in Safety**—Since the main objective of any pressure-vessel code is to aim for a 100% safe performance by any vessel manufactured to its specifications, the revisions proposed by Kellogg consider fully the influence of service on safety. (*Continued*)

*In a paper by J. J. Murphy, C. R. Soderberg, Jr., and D. B. Rossheim presented at the Mid-1955 meeting of the American Petroleum Institute's Division of Refining.



The high speed camera pictures show the Eimco Drum Filter with cake formed on the drum, cracked and leaving the panel clean.

SAVE WITH A SNAP!

Greater savings are being realized by many companies in filter media and filter down time where the use of a snap blow is practical for the product being filtered.

Snap blow on Eimco filters is accomplished by introducing high pressure air for a fraction of a second at the discharge point. This action on a heavy salt cake is shown above taken with high speed photography. The three successive pictures were taken only seconds apart as shown by the clock.

Advantages are in being able to move the scraper blade back so that it never touches the media and acts only as a deflector. The high pressure air helps keep the media free of blinding particles so that tonnage goes up — maintenance goes down.

Snap blow may be ordered with your Eimco filter, properly installed and regulated at the factory or, you may purchase a "snap blow" kit to install on your present fitler.

An Eimco engineer will be glad to advise the practicability of snap blow on your product. Write for more information.

THE EIMCO CORPORATION

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New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Baltimore, Md. Pittsburgh, Pa. Seattle, Wash. Pasadena, Calif. Houston, Texas Vancouver, B. C. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa

B-151

This includes evaluation of hazards resulting from overpressure, overtemperature and other effects. Some of these might be explosion, resonance, dynamic (flow and structure) effects, nuclear fission, deterioration, corrosion, heat transfer, thermal gradients and expansion.

▶ **New Service Classes**—The authors' proposal suggests a new service basis for modifying existing codes. There should be at least three general classes of unfired pressure vessels, they say. These would be specified as Classes *C*, *G* and *N*.

Class *N* would substitute extra thickness for refined design and fabrication. This represents a class of construction as currently provided for in the code with a safety factor of 5. Materials would be restricted to ductile carbon steels and noncyclic service.

Class *G* is a more balanced spot-checked construction that continues the present safety factor of 4, and provides a vessel that develops the average potential of the base material.

Class *C* would provide a fabricated pressure vessel developing the full potential of the base material. It would be a new construction representing an optimum use of new high-strength less-ductile materials. Vessels for high-temperature service in the creep range would be placed in this class. Class *C* represents a higher quality of engineering design and more thorough inspection than has ever been defined in a code before.

By specifying the details of the design requirement, the Kellogg engineers suggest that a safety factor of 3 can be justified.†

▶ **What About Creep?**—Pending the evolution of a different agreement which is representative of fatigue-test data, Kellogg considers it advisable to retain the ultimate tensile strength as the basic short-time property on which allowable stresses are based for service temperatures below the creep range.

There has always been considerable opinion that the allowable stress can be simply related to the yield strength, regardless of ultimate tensile strength and other properties. However, the authors reason that no single physical property reliably predicts over-all performance. Rather, the influence of each of these factors must be included:

- Ultimate tensile strength.
- Yield strength.
- Elongation.
- Fatigue resistance.
- Transition temperature.
- Creep.

This will require more investment in careful engineering design of pressure vessels but should pay off in reduced over-all costs.

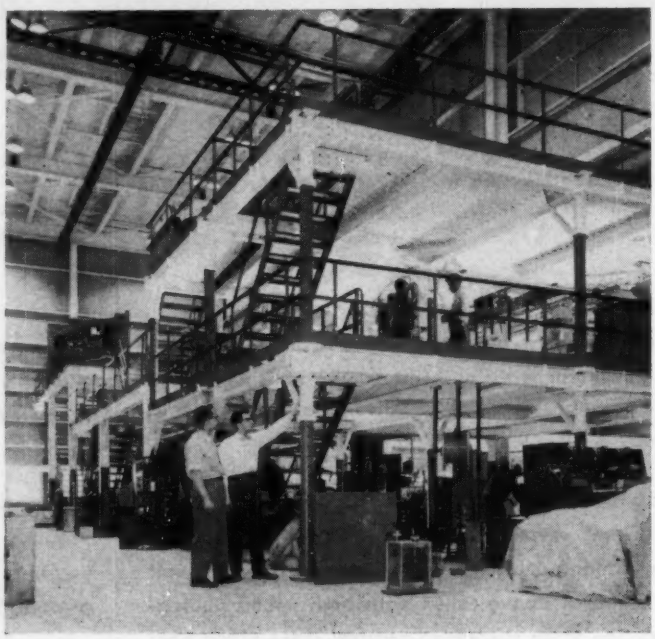
And this ought to hold true even after the increased costs of more careful fabrication are added.

†All safety factors are related to the ultimate tensile strength, as has been the case for many years.

Lone Star Cement Expands Again

A $14 million, 2-million-bbl./yr. cement plant in Lake Charles, La., is part of a new $35 million round of expansion for Lone Star Cement Corp. The third announced this year, it brings the company's total planned expenditure to $57 million and planned new annual capacity to 10.2 million barrels.

Most of the expansion is due for plants near Lake Charles. This area suffered an acute shortage of cement last summer and at least one other cement company, Ideal Cement, is also contemplating the construction of a plant in the same region, at West Lake, La. The Lone Star plant will be completed late in 1956.



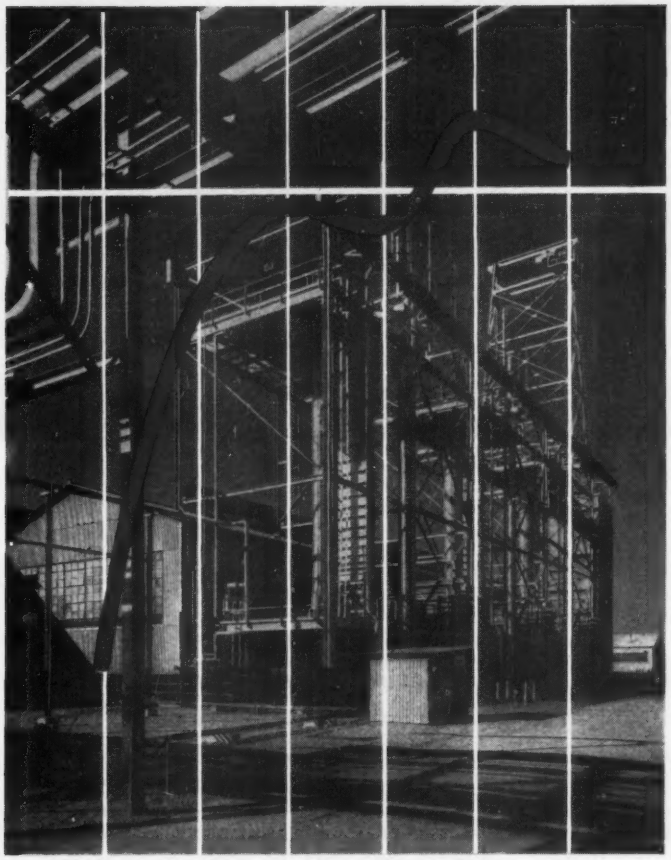
New Way to Lab Versatility

One highly desirable feature of any pilot plant is flexibility to test a variety of processes. To help achieve this, General Electric, in its new Schenectady, N. Y., metals and ceramics lab, has turned to an "erector-set" construction (above). Columns and beams are punched on 4-in. centers for adjustability so that as processes are developed or changed structural members can quickly be taken apart and reassembled into different supporting arrangements.

AMMONIA PRODUCTION AT GRACE CHEMICAL

goes "OVER THE TOP"

with exclusive FW Sequence



The above curve shows average monthly output of liquid anhydrous ammonia at the new Grace Chemical Company plant in Memphis, Tenn.

From "on stream" to full capacity production, on the basis of monthly averages, was achieved within 3½ months—a short period of time for a completely new plant. On a *daily* basis, full production was actually exceeded within 30 days from start-up. And the average monthly production, 90 days later, was *well above* the rated plant capacity.

This demonstrates the ease and rapidity with which the FW sequence for ammonia synthesis can be put on stream and raised to full production capacity, and proves the efficient functioning of all elements of the system—Texaco partial oxidation, FW liquid nitrogen wash and Casale ammonia synthesis.

For complete information on this Grace plant installation, send for the Mar.-April 1955 issue of "Heat Engineering." *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*

FOSTER WHEELER

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NEW BARGE adds substantially to the transportation capacity available as . . .

Molten Sulfur Movement Gains Momentum

If economy and purity are prime considerations in your sulfur-using processes, check on the advantages of receiving liquid-state shipments. It's a growing trend.

When Monsanto's Everett, Mass., plant received its first shipment of 2,500 tons of liquid sulfur from Freeport Sulphur's Port Sulphur, La., works recently, it made news because it was the first cargo of molten sulfur ever transported on the high seas.

But it was also noteworthy for underscoring the trend toward shipping sulfur in the liquid state—a trend that has been growing slowly since shortly after the end of World War II. R. L. Miller, plant manager of the Everett works, referred to this development when he said, "It has been predicted that this method of shipping sulfur will become standard on the East Coast within five to ten years."

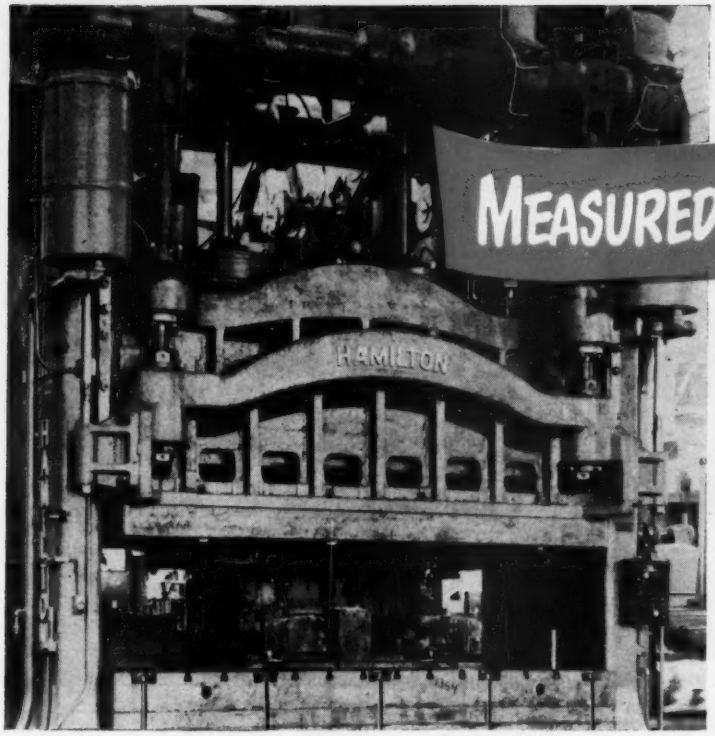
Today, one producer estimates that liquid sulfur shipments—whether over land or water—account for some 14% of total domestic shipments to consumers. Others say that this estimate is high—but all admit that liquid shipments form a growing part of their business.

► **Distance Hauling New** – Long-haul water shipment of molten brimstone is a recent innovation—although Freeport has moved barges of the liquid between points on its own canal at Port Sulphur for some 10 years now. Last May's shipment of 5,000 tons from Port Sulphur to National Lead's Titanium Division at St. Louis, Mo., about 1,000 mi. up the Mississippi, shattered all prior records for waterborne shipments.

In addition, a number of users receive the molten mineral in tank car and tank truck quantities. Most of these have been short-haul operations in tanks of "thermos bottle" construction. In general, users plan their receiving schedules so that they consume the sulfur soon after it arrives. This keeps the investment for receiving facilities comparatively modest.

► **Check Advantages** – Some users, however, feel that the economies derived from using the liquid form can be increased by setting up proper receiving and storage facilities—even to the extent of making long hauls practical. G. Hunter Miley, superintendent of the sulfuric acid plant at the Petrolia, Pa., refinery of L. Sonneborn Sons, Inc., cites these advantages for a liquid handling system installed a few years ago:

• **Cut** unloading time and saved labor. Converting from box-car to tankcar operation reduced



MEASURED LUBRICATION

SOLVES YOUR BEARING SITUATION

What used to be done by hand is now done *automatically.*

We're referring to your specification of a Trabon lubrication system, which absolutely guarantees that the right amount of oil or grease will be delivered to vital bearings, at the right time and in the right place.

Our patented progressive feeder system assures this measuring-cup accuracy because the operation of each feeder depends on the previous feeder having operated first.

WE HAVE 2 BASIC SYSTEMS:

TRABON REVERSIBLE SYSTEM

This system is simply a lubricating pump and a series of reversing feeders, connected with a single line of pipe or tubing, forming a continuous sealed circuit running from the pump, around the machine and back to the pump. As the lubricant oil or grease travels, it operates the metering piston of the first feeder in the line, which discharges an exact volume of lubricant to the bearing connected to that outlet. The operation of this piston exposes a port in the feeder, thus permitting the lubricant to flow on through the circuit to the next feeder in line, where the operation is repeated. When the last feeder has discharged its lubricant, the main flow travels back to the pump where it operates an indicator stem, thereby giving visible proof that the circuit has been completed.

TRABON MANIFOLD SYSTEM

The Trabon Manifold Systems are single line combinations of feeders or measuring valves, with no external moving parts and no soft packings, which accurately proportion the volume of lubricant discharged by a pump (either manually or automatically) to the bearings of a machine. The feeder sections are manifolded into distributor assemblies to serve groups of bearings. One assembly, the first one from the pump, often serves as a master block, feeding secondary assemblies, which in turn discharge the correct volume to each connected bearing. The "M" and "MX" feeders are the same type, the "MX" being the larger.

Get your bearings on a Trabon system.

Trabon Automatic Lubrication Fits Any Bearing Situation

Bulletin 529 will give you more details.

Trabon ENGINEERING CORPORATION

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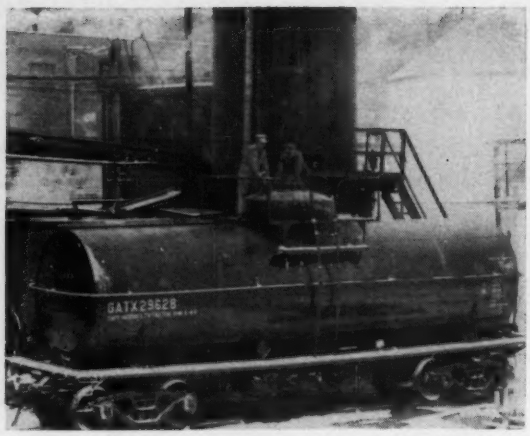
Oil and Grease Systems

SULFUR HILLS yield to space-saving tanks, when . . .



MOLTEN SULFUR flows to storage—even in winter.

labor requirements to one-tenth. There's a similar saving in time.

• Erased health and safety hazards connected with the handling of solid sulfur—particularly the problem of skin and eye irritations in warm weather.

• Eliminated contamination woes. Solid sulfur sometimes becomes contaminated by cinders, soot and moisture, resulting in clogged burners, damaged catalyst, etc. The liquid arrives in virtually its original, fresh-from-the-mine purity—and any impurities settle out in storage.

• Ended losses caused by windage. When solid sulfur was stored in open piles this was a costly nuisance.

• Simplified stock-taking. With liquid, your inventory can be determined simply by gaging a tank.

▶ **Simple Equipment**—At Sonneborn, equipment for handling approximately 300 tons of molten sulfur per month is relatively simple. On arrival, the tankcars are heated overnight to 265° F., then put under 10 psig. air pressure. This forces the sulfur out to a receiving pit.

The unloading pipe is not steam-traced, but the pit has steam coils to keep the mineral molten. It takes 3-3½ hr. to empty a car carrying 72 tons of the liquid.

After allowing heavier contaminants to settle, a vertical, steam-driven pump, submerged to within a foot of the pit-bottom, transfers it to the storage tank.

The welded, carbon steel storage tank is lined on the inside with common red building brick laid flat with acid-proof cement. Between the brick and the wall are two courses of ¼ in. asbestos paper painted with sodium silicate. The outside is lagged with 2½ in. of asbestos, surfaced with asbestos cement. A 1-in. mesh screen, coated with ¼ in. winter grade Insulkote, completes the insulation.

This heavy insulation proves its worth by saving steam and keeping sulfur temperature at 265° F.—regardless of weather conditions.

Steam-traced lines and a constant level pit for burner feed complete the Sonneborn installation.

▶ **In the Future**—Although sulfur men expect the percentage of shipments "going molten" to rise, none feel that the prime position of solid-state shipments will be threatened.

A general lack of adequate handling facilities for water-transported sulfur and a reluctance to invest the required amount to handle a single type of cargo are looked on as the major drawbacks.

Barges and other equipment to haul and handle liquid sulfur are not readily used for other materials.* Hence, the single cargo has to bear the cost of the two-way trip. In addition, cramped conditions at some ports preclude adding facilities which have such a specialized use. And it's water transportation that appears to offer the greatest savings to the user of liquid sulfur.

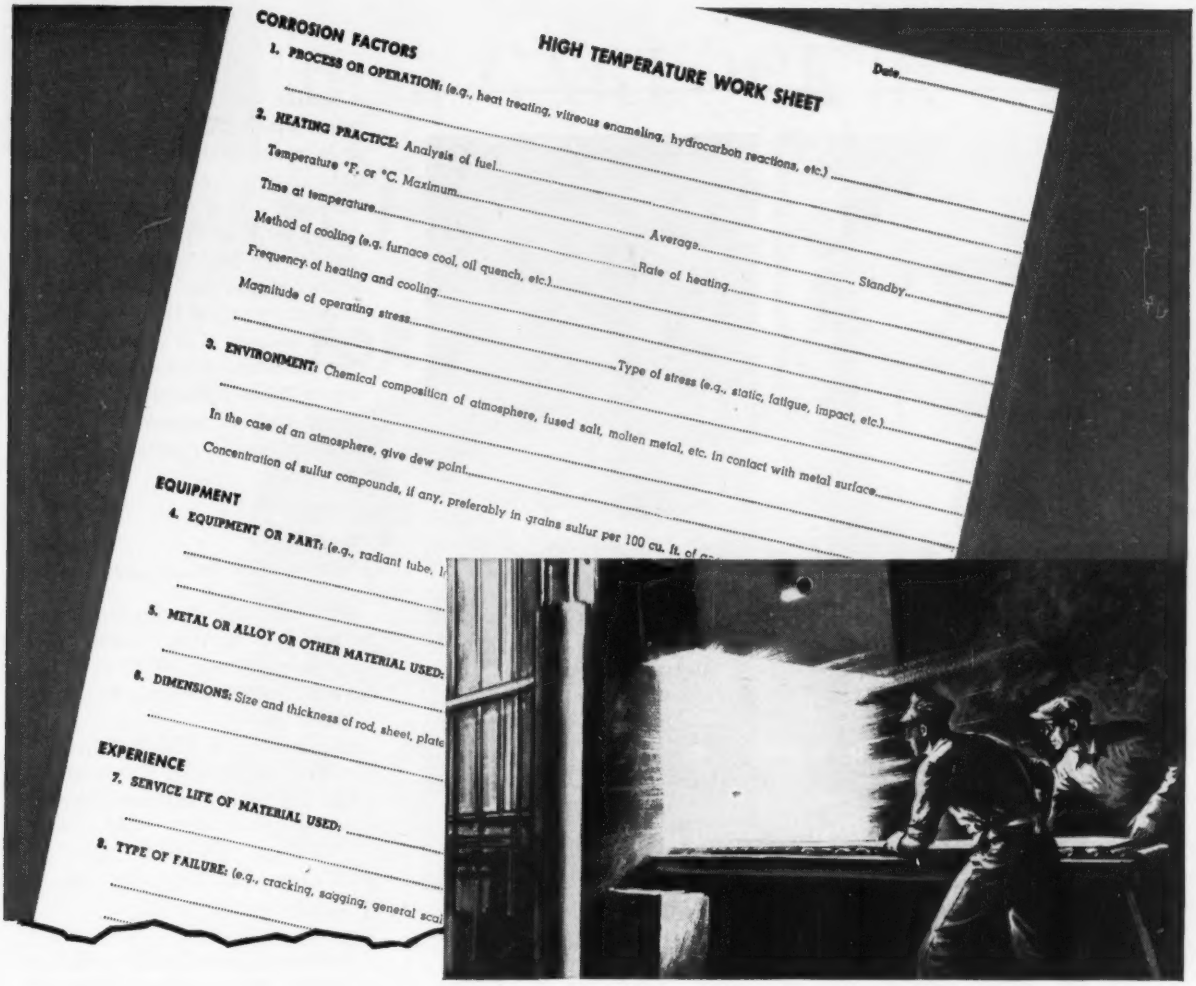
* Monsanto expects to use its new barge to ship sulfuric acid from the Everett installation. National Lead uses barges which are able to handle deck cargo on the return trip.

Titanium Pigments To Be Made in Canada

A $15 million plant designed to meet Canada's entire requirements for titanium oxide will be built at Varennes, near Montreal, by Canadian Titanium Pigments Ltd., subsidiary of National Lead Co. To be completed early in 1957, it will be Canada's first such plant.

Big Pulp Mill Planned for Alaska

Preliminary to construction of a $60 million pulp mill at Juneau, Alaska, the Georgia-Pacific Alaska Co. has entered a successful bid with the U. S. Forest Service for 7.5 billion bd. ft. of timber in the area. Contract requirements call for the production of 500 tons of pulp a day by July 1, 1961, increasing to an eventual daily production of 750 tons. But before July 1, 1958, the firm must show financial ability to construct the pulp mill and carry out terms of the $14.5 million timber sale.


CORROSION FACTORS
HIGH TEMPERATURE WORK SHEET
Date
1. PROCESS OR OPERATION: (e.g., heat treating, vitreous enameling, hydrocarbon reactions, etc.)
2. HEATING PRACTICE: Analysis of fuel
Temperature °F. or °C. Maximum
Average
Standby
Time at temperature
Rate of heating
Method of cooling (e.g. furnace cool, oil quench, etc.)
Frequency of heating and cooling
Magnitude of operating stress
Type of stress (e.g., static, fatigue, impact, etc.)
3. ENVIRONMENT: Chemical composition of atmosphere, fused salt, molten metal, etc. in contact with metal surface
In the case of an atmosphere, give dew point
Concentration of sulfur compounds, if any, preferably in grains sulfur per 100 cu. ft. of
EQUIPMENT
4. EQUIPMENT OR PART: (e.g., radiant tube,
5. METAL OR ALLOY OR OTHER MATERIAL USED:
6. DIMENSIONS: Size and thickness of rod, sheet, plate
EXPERIENCE
7. SERVICE LIFE OF MATERIAL USED:
8. TYPE OF FAILURE: (e.g., cracking, sagging, general sca

When you need suggestions on a specific high temperature problem...

The High Temperature Work Sheet has been designed to make it easy for you to outline your problem as completely as possible and to make sure no significant factors will be overlooked. The completed form will assure your receiving information most applicable to your particular requirements.

Use this Work Sheet as a convenience in stating your problem in the event that you:

1. Are undertaking a new process involving the possibilities of corrosion at temperatures with which you have not had operating experience.
2. Wish to compare the performance to be expected from other metals and alloys with that of materials previously used and found satisfactory.
3. Require a substitute for an alloy or material at present not readily available.

Fill in and return this coupon.

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Please send me the High Temperature Work Sheet so that I may outline my problem to you.

Name_____ Title_____

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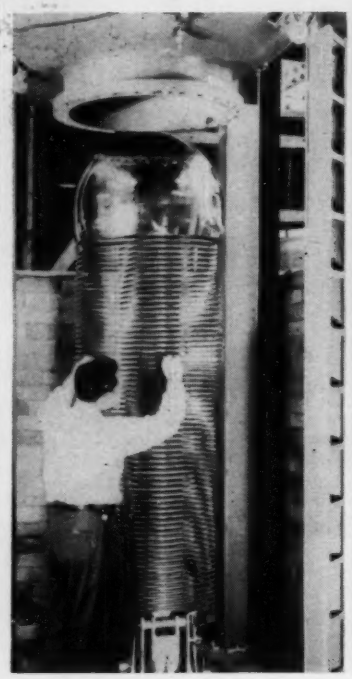
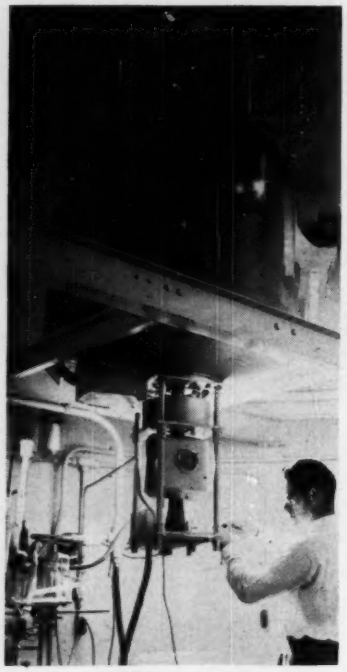
Address_____

City_____ State_____





Industry Atom Smashers Probe Oil Molecules

Here's more indication of the growing push in the process industries to harness the atom for peacetime use. Two oil companies, Gulf and Atlantic Refining, have just added atom smashers to their private stock of research tools. Both will investigate the strong possibility that the use of atomic radiation, instead of heat, for petroleum processing will up both volume and variety of petroleum derivatives.

The Gulf unit, to be housed at Harmarville, Pa., is a 3-million-volt Van de Graaff particle accelerator capable of producing electrons, X-rays, positive ions or neutrons. Shown above, left, is its voltage generating column. Atlantic Refining's unit is a 1-million-volt electron gun in Philadelphia. Adjustment of the gun's aperture, through which electrons will shoot, is shown above, right.

GE Cuts Cost of Radioactive Waste Disposal

With new methods for handling both high level and lower level radioactive wastes, General Electric Co. engineers at the AEC's Hanford works have made substantial progress toward safe and effective, yet economic, disposal.

After careful studies of the specific geologic conditions of the Hanford area, they found that millions of gallons of radioactive residue could be dumped onto the ground surfaces to filter slowly through hundreds of feet of soil, gravel, rock and clay and be safely trapped by desert soil. Although not of the highest radioactive level, these wastes would formerly have had to be stored in expensive underground tanks, and millions of dollars have already been saved via the new method.

Conditions at Hanford are regarded as nearly perfect for ground disposal of radioactive wastes. However, experiences there are expected to serve as a useful guide at other, less suitable atomic energy installations.

For the very long-lived "hot" elements which must still be disposed of in underground tanks, GE engineers have also devised storage economies. They have developed a design for the storage tanks which permits the heat generated by reactions within the waste itself to evaporate much of the water in the waste solution. Consequent reduction in volume minimizes the number of tanks required and has reduced cost of permanent storage to less than 25¢ a gallon.

News Briefs

Silicones: Linde Air Products Co.'s new $14 million silicones plant at Long Reach, W. Va., is just about ready to start up.

Fischer-Tropsch: Hidalgo Chemical Co., subsidiary of Stanolind Oil & Gas Co., expects first chemical production from the former Carthage Hydrocol plant at Brownsville, Tex., by Jan. 1, 1956.

Uranium: Union Carbide and Carbon's big uranium processing mill at Uravan, Colo., is undergoing a new expansion which should be finished early in the fall of 1956.

Hydrogen chloride: Hooker Electrochemical Co. has authorized a $3 million expansion at its Montague, Mich., chlorine-caustic plant, mostly for production of hydrogen chloride gas.

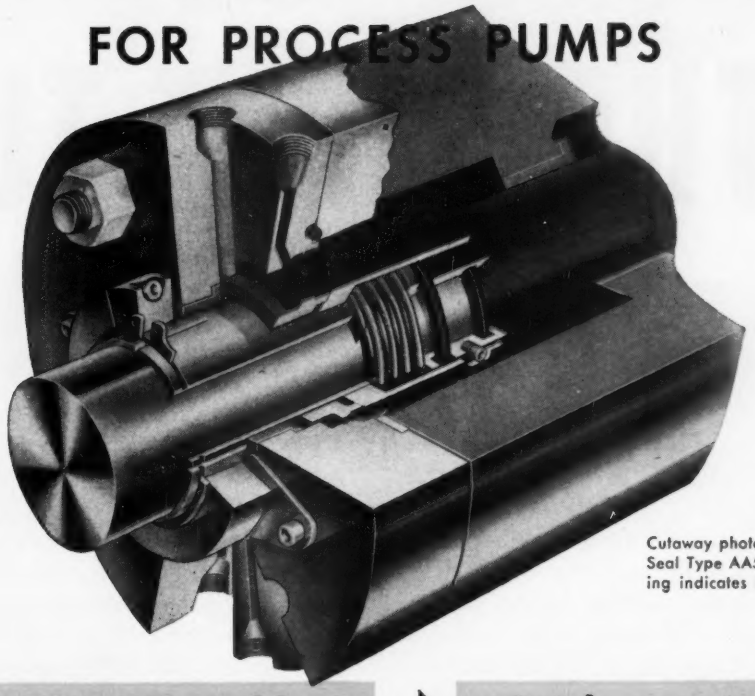
Vinyl acetate: Carbide and Carbon Chemicals Co. has started a multi-million dollar expansion at Texas City, Tex., to gain more vinyl acetate capacity. Also, at Seadrift, Tex., Carbide is adding a new ethanolamine unit.

Coatings: American Marietta Co., Chicago, is planning a $10 million expansion in its North American resin and paint facilities and has purchased Stoner-Mudge, Inc., Pittsburgh, Pa., makers of coatings for can linings.

NEW from GARLOCK...

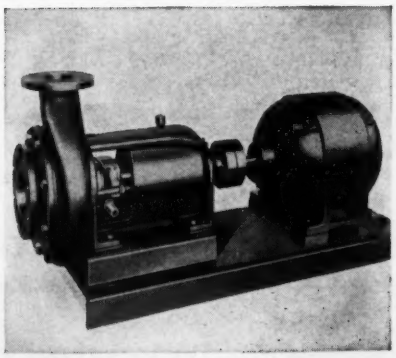
MECHANIPAK* SEALS

FOR PROCESS PUMPS



Cutaway photo of Garlock Unitary Seal Type AA51B-23. Yellow shading indicates liquid being sealed.

- One Piece Assembly
- Quick, easy installation
- Pre-set at factory
- Maintenance-free life



Typical chemical pump for which Garlock Unitary Seals are designed.

FOR COMPLETE DETAILS, VISIT OUR BOOTH 405 AT THE CHEMICAL SHOW

*Registered Trademark

SAVE installation time, eliminate maintenance costs with Garlock's new Unitary Mechanipak Seals for process pumps!

The entire unit, including sleeve and gland, is furnished completely assembled. The seal is pre-set at the factory—no on-the-job adjustments are needed. The *external* lock and drive is readily accessible—eliminates set-screw drive.

Get all the facts today! Phone your Garlock representative or write for new Folder AD-151.

The Garlock Packing Company, Palmyra, New York

Sales Offices and Warehouses: Baltimore, Birmingham, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Denver, Detroit, Houston, Los Angeles, New Orleans, New York City, Palmyra (N. Y.), Philadelphia, Pittsburgh, Portland (Oregon), Salt Lake City, San Francisco, St. Louis, Seattle, Spokane, Tulsa.

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GARLOCK

tubing selection:

THE RIGHT TUBE — FOR THE JOB

Even after the design engineer has worked his way through the extremely complex problem involving consideration of pressures, temperature, oxidation and corrosion and has selected a tubing analysis that will fulfill the service requirements of the job there still is a rather complex problem to solve . . . What is the right tube for the job?

For instance—in the case of a heat exchanger or condenser—should the tubing be seamless or should it be welded? Should it be a single length or center welded to provide an unusually long length? What about tolerances? What sort of mechanical properties are needed to provide ease of fabrication? What about heat treatment? Will a standard specification be satisfactory or is a special specification necessary?

These are but a few of the many possible combinations which must be sorted out to determine the right tube for a job. And the right tube is the one that will do a completely satisfactory job over an extended period of time and at the lowest cost—the one that provides long term economy.

Tubing selection requires expert judgment and experience—and there is no substitute for the kind of experience that you will find at B&W. To get the most benefit from B&W's long experience in matching tubes to jobs, in *every* respect, call on Mr. Tubes, your nearby B&W Tube Representative. He has helped others, as he can help you, make tubing selection *surer.*

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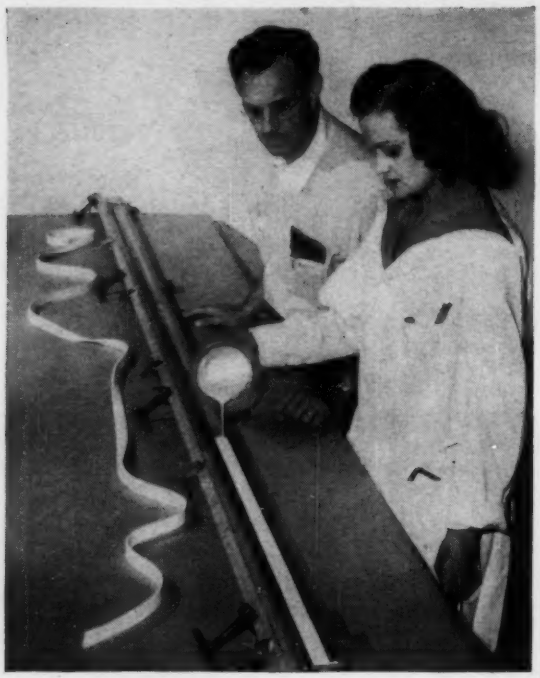
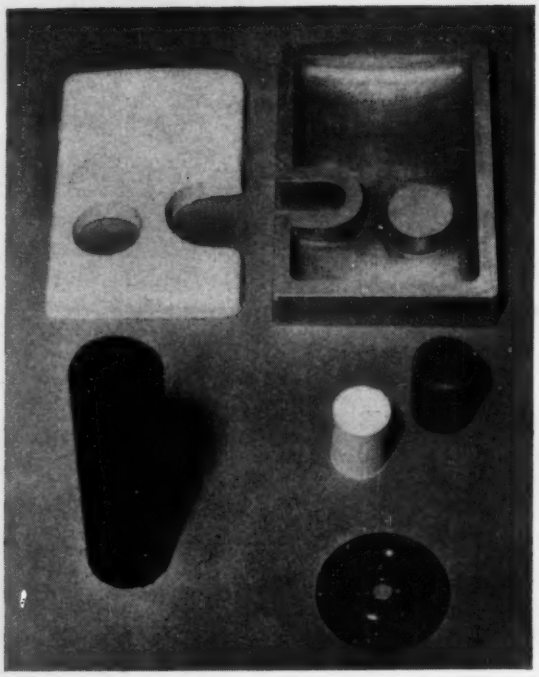
TA-5055P



Easy compounding.



Many forms.

Polyrubber: Your Pick of Properties

Here's a material which has many guises—hard or soft, stiff or elastic—a rubbery polyurethane you can mold and one which can mold for you.

Industry has long been on the lookout for a rubbery substance that could be easily compounded for experimental, prototype and short runs as well as for mass production. It has wanted a material resistant to chemicals, gases and abrasion but which could be formulated and fabricated more easily and efficiently than the natural and synthetic rubbers on the market.

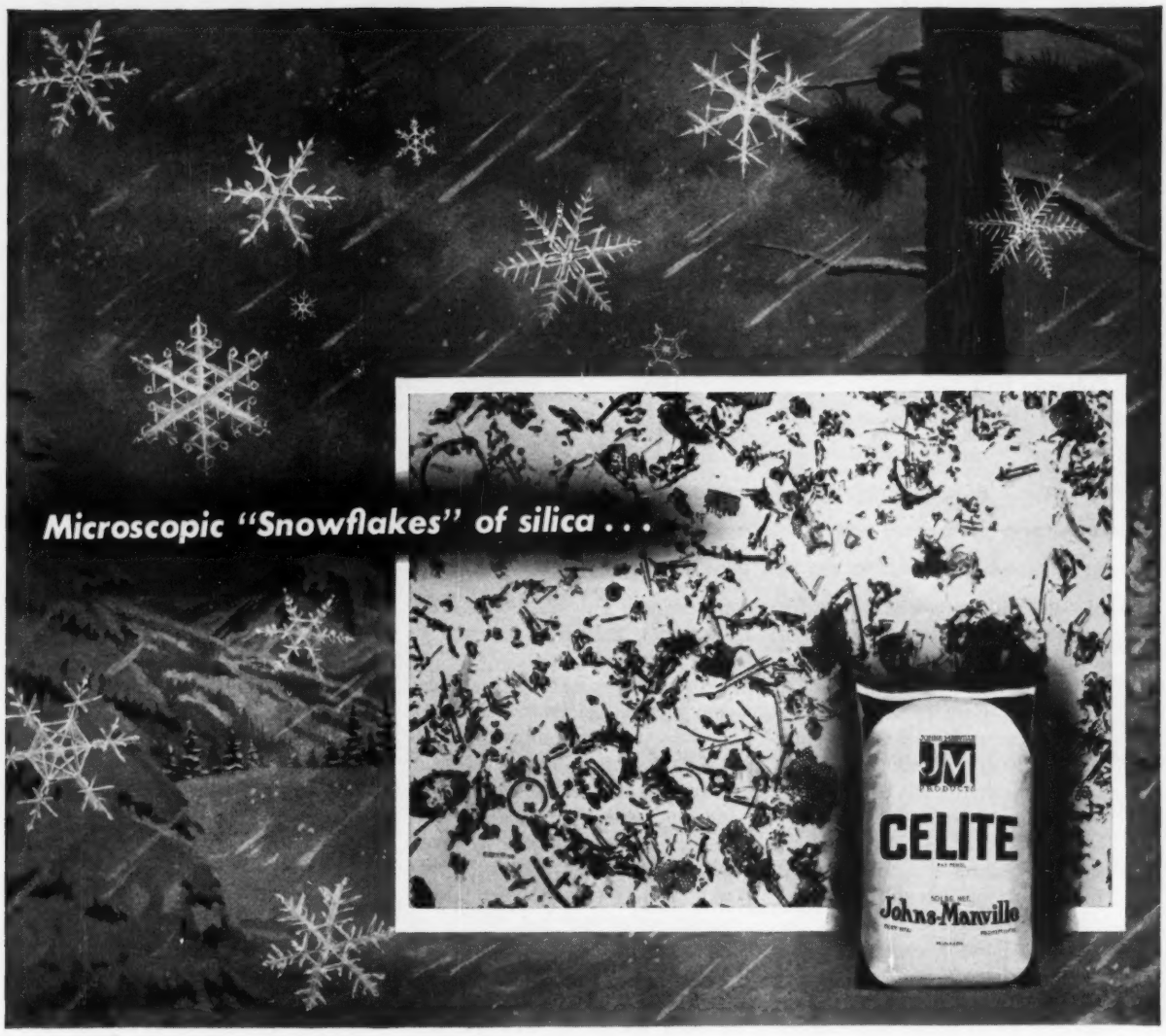
American Latex Products Corp. Hawthorne, Calif., feels its material, a polyurethane called Polyrubber, will meet industry's need. Formulated simply at room temperature by adding an isocyanate catalyst to a polyester resin base, Polyrubber can assume densities of 3-53 cu. ft./lb., possess elongation characteristics of 0-300%, range from a hard material to one with a soft, open-cell structure similar in many ways to foam rubber.

Aside from its variable physical properties Polyrubber has certain chemical advantages over natural rubbers and most synthetics, according to American Latex. These include a high degree of resistance to temperature extremes (-40 F. to 300 F. without change), dilute acids, most solvents, oils, aromatic fuels and other deteriorating chemicals. And Polyrubber is virtually impervious to sunlight and salt water. Since no plasticizers are required in Polyrubber formulations, resistance to oxidation, too, is extremely high.

Unlike other rubbers or synthetics, Polyrubber can be molded to another piece of the same material without special equipment. It forms a smooth, perfect seam or joint having a tensile strength equal to any of its parts.

Currently being used for everything from arm rests to pump diaphragms, Polyrubber is thought to have a future use even in automobile tires, shoe soles and airplane parts subject to supersonic erosion.

Basic Polyrubber components will be offered to industry in a range of standard formulas to fit a wide variety of demands. Form-



Celite's diatomite structure steps up performance

in paints—plastics—polishes . . . hundreds of other products

MICROSCOPIC PARTICLES of Celite* do a man-size job of stepping up performance for many of America's leading products. Here is how the unique structure of Celite Diatomite Powders may add more beauty, longer life, greater efficiency to *your* products, too.

For example, the spiny, irregularly shaped particles contribute surface characteristics which make them the outstanding flatting agent in paints. Again, because of their structure, Celite particles are widely used as a mild, non-scratching abrasive in finest quality auto, silver and glass polishes. Or consider molded plastics, where the strength and durability of Celite particles add life and beauty to surface finish.

Moreover, Celite particles in mass have great bulk per unit weight, so they are invaluable for extending, dispersing or fluffing up dry powders. They have high absorptive capacity, too, so they keep powders free-flowing, they serve as a medium for shipping or storing liquids in a dry form.

Which of the many Celite advantages can you use to build product performance or cut production costs? A Johns-Manville Celite Engineer will gladly discuss your problem, without obligation. For his services or more information, simply write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay Street, Toronto 1, Ontario.

*Celite is Johns-Manville's registered Trade Mark for its diatomaceous silica products.

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Rubbery polyurethane assumes many forms 142A
Flamesprayed ceramic coatings..... 146A
Nitrile latices bind non-woven fabrics.... 146B
Sealing compound for underground storage. 146C
Malonaldehyde diacetal 146D
High quality calcined alumina..... 148A
Waterproof adhesive applies rapidly..... 148B
Polyester bull 148C
Radiation shield 148D
Clearer polyester resin..... 150A
Rubber compound resists refrigerants.... 150B
High-purity domestic aluminum..... 150C
Pelleted zinc oxide..... 150D
Antisoiling compound 150E
"Slow release" nitrogen fertilizer..... 150F
Carbon black fillers for silicone rubber... 150G
Textile processing surfactant..... 150H

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ulations will be provided, too, for non-standard needs in basic industries.

Thus, rubber casting shops, engineers, research laboratories and others can have different Polyrubber grades with which to make different types of parts. Raw material may be stored for about six months without change.

▶ **Cost Picture**—At the present time, costs of Polyrubber in production are difficult to assess. Today, the finished compound sells for approximately $4.50 per pound. Natural rubber is in the neighborhood of 45¢ a pound and synthetics, about 80¢ per pound, uncompounded. However, American Latex estimates that in many instances the final cost of Polyrubber products will be nearly equal to those of natural or synthetic rubbers. Eliminated are the expense of additives necessary to correctly compound rubber and synthetic materials; the design, manufacture and use of hot molds, extruding machines, presses, etc.; and the extra labor involved.

In the fields of experimental engineering, prototype construction, short runs, and in applications where the material is bonded to the product as an integral part, the cost of Polyrubber in the finished item should be far less than natural rubber or synthetics.

▶ **Prototype Potential**—In its role of a convenient material for forming prototypes or models for parts made from Polyrubber or other substances, Polyrubber can already make claims to success.

An oil tool manufacturing company needed an experimental oil resistant, sponge rubber-like hose of specific dimensions. Rubber die makers quoted a price of $2,500 for the tooling to make the part just for testing purposes. However, the company did not know for certain that the proposed sleeve would suffice and had no way of testing its adequacy until one was installed.

American Latex chemists built a mold out of one-inch ordinary gas pipe set on a wooden dowel, placed a 2-in. gas pipe over the assembly, spaced it to give the desired wall dimensions and start pouring the Polyrubber ingredients. In less than two hours the oil tool company had eight sleeves for testing.

Another oil tool company needed a diaphragm of uncertain characteristics for an experimental oil pump. Within one hour after an aluminum mold costing $22.50 had left the lathe, a Polyrubber diaphragm had been cast. The part was tested, corrections applied quickly to the design and an eight-gang mold made up for mass production at a total cost of $175.

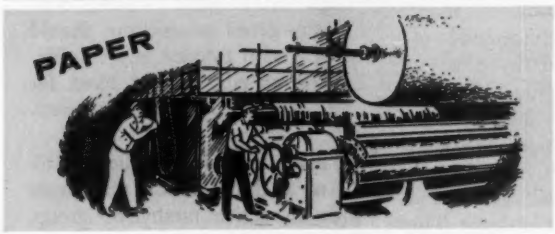
▶ **End-Use Value, Too**—Industrially, Polyrubber is suited for vibration damping (particularly where it can be cast as an integral part of the equipment) and in plant flooring, walkways, or running boards where its resistance to abrasion, chemicals, and slipping would be valuable. It should also prove useful as conveyor and power transmission belting, as a coating for sandblasting booths, and as the prime material for high pressure hoses carrying abrasive or chemical substances.

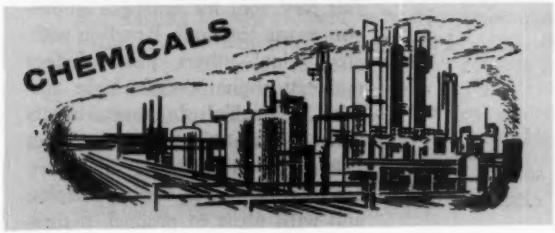
Chemists and engineers expect Polyrubber to solve several marine construction problems. As sunlight and salt water immersion have little effect on Polyrubber, the material is indicated for use as non-slip deck covering, applied by brush or spray; as a sealant and easily-applied caulking for decks and hulls; as engine gasketing; as a dip for railings and other metal objects; and even for coating the interior of salt water pipes.

Polyrubber is finding many uses in the aircraft industry as a replacement for rubbers or synthetics and in new applications where rubbers or synthetics cannot meet conditions required. Its resistance to aromatic fuels and oil will help produce better gaskets, fuel tanks and tank liners, and fuel sealants, its designers claim.

Automotive manufacturers long have been plagued with the breakdown of present weatherstripping from exposure and wear. Replaced with Polyrubber, these items should remain in their original condition for the life of the automobile, tests indicate. Its high re-

Heyden FORMALDEHYDE helps in Industry's BIG JOBS...





It is interesting to note that further growth is predicted for the major products made from Formaldehyde. This applies, for instance, to phenolic molding and laminating resins—urea and melamine resins for textiles, paper and plywood—and various organic chemicals.

Heyden Formaldehyde is helping in this growth, as it has right from the original development of these products. Experience, gained through this long association with customer problems, has enabled Heyden to meet the most exacting needs of each use. As new applications arise, Formaldehyde with the proper specifications will be available from Heyden.

Both methanol-inhibited (N.F.) and methanol-free forms of Formaldehyde are supplied by Heyden. If this chemical is one of your raw materials, why not discuss your requirements with the Heyden sales office nearest you.

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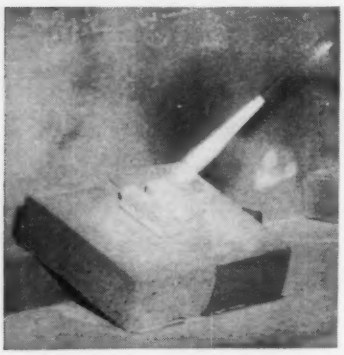
sistance to heat, oil, aromatic fuels and abrasion predicates its use in engine gaskets and long-wearing tires.

Developers of the product envision homes where Polyrubber will be found as a lining for easily cleaned, non-slip bath tubs; chip-proof sinks; automatic dish and clothes washer linings; as kitchen and bathroom floor tile and wall coverings; and as a coating for swimming pool walkways and diving boards. 142A



Flamesprayed Ceramics

Aluminum oxide coating is readily applied to many materials.

Twice as hard as tool steel, with a melting point above 3,600 F. and unaffected by most corrosive agents is Flame Rock coating.

Flame Rock, says the manufacturer, Montaine Corp., can be easily and inexpensively applied via its own improved flamespray process. (Ceramic powder is melted in a flame directed at the object to be coated—see cut.) In fact, says Montaine, application equipment is priced low enough to permit even the smallest shop to apply Flame Rock.

The super refractory material will bond to such materials as steel, titanium, carbon, brass, aluminum and glass to give a coating that's chip-resistant and provides electrical as well as thermal insulation. And Flame Rock's slight porosity absorbs lubricants, thus fitting it for bearing applications.—**Montaine Corp., Chicago 19, Ill.** 146A

Nitrile Latices

Consumption is up for these binders for nonwoven fabrics.

Four million lb. in the first six months of 1955, 6.5 million lb. for the same period this year. This is the consumption record for nitrile latices in the chemical, textile and related fields, according to Goodyear Tire & Rubber, maker of Chemigum nitrile latices.

Credit much of the increased consumption to the use of nitrile latices in the manufacture of nonwoven fabrics as backing for vinyl sheet. The latices bind the individual textile fibers together to give equal strength in all directions. In many of this year's cars the two materials are being used in combination for such upholstery items as door paneling, scuff pads and seat bolsters. The nonwoven fabric provides strength and support to the exterior vinyl sheet and eliminates the need for heavier and costlier backing materials.

Nitrile latices are also being used in increasing quantities as carpet backing materials and in combination with other latex products for new improvements in textiles. Rugs and carpets are made more durable, ravel-free and resistant to water and dry cleaning solvents. A combination of Chemigum and Pliovic latices gives fabrics better abrasion resistance and tensile strength, superior adhesion, and good oil, grease and solvent resistance.—**Goodyear Tire & Rubber Co., Inc., Akron 16, Ohio.** 146B

Storage Seal

Tough coating secures underground storage chambers and concrete tanks.

More and more of industry—especially the liquid petroleum gas producers—is shifting to underground excavations, natural or otherwise, for low cost storage of bulk liquids. Coatings used to seal off these chambers must be tough, resilient and chemically inert to the materials they contain.

Examples of these sealing compounds are the Rock Seals, a series of emulsions of neoprene and silicone rubbers which, together with resins and compounding agents, cure to form nearly impervious films on the inner walls of underground storage chambers.

The Rock Seals are highly resistant to oils, gasoline, propane, butane, kerosene, fuel oil, brine, acids, ammonia, alkalis and most other chemicals and solvents. They are resistant to vibration, expansion, contraction, abrasion and high pressures. They withstand repeated flexing and retain their flexibility from —65 to 300 F.

First job for these compounds was to seal a chamber cut out of porous standstone for liquid propane storage at 160 psi. Tests show that the Rock Seals are also effective for limestone, shale, granite and concrete.—**Storage and Sealing Corp., Minneapolis 2, Minn.** 146C

Malonaldehyde Diacetal

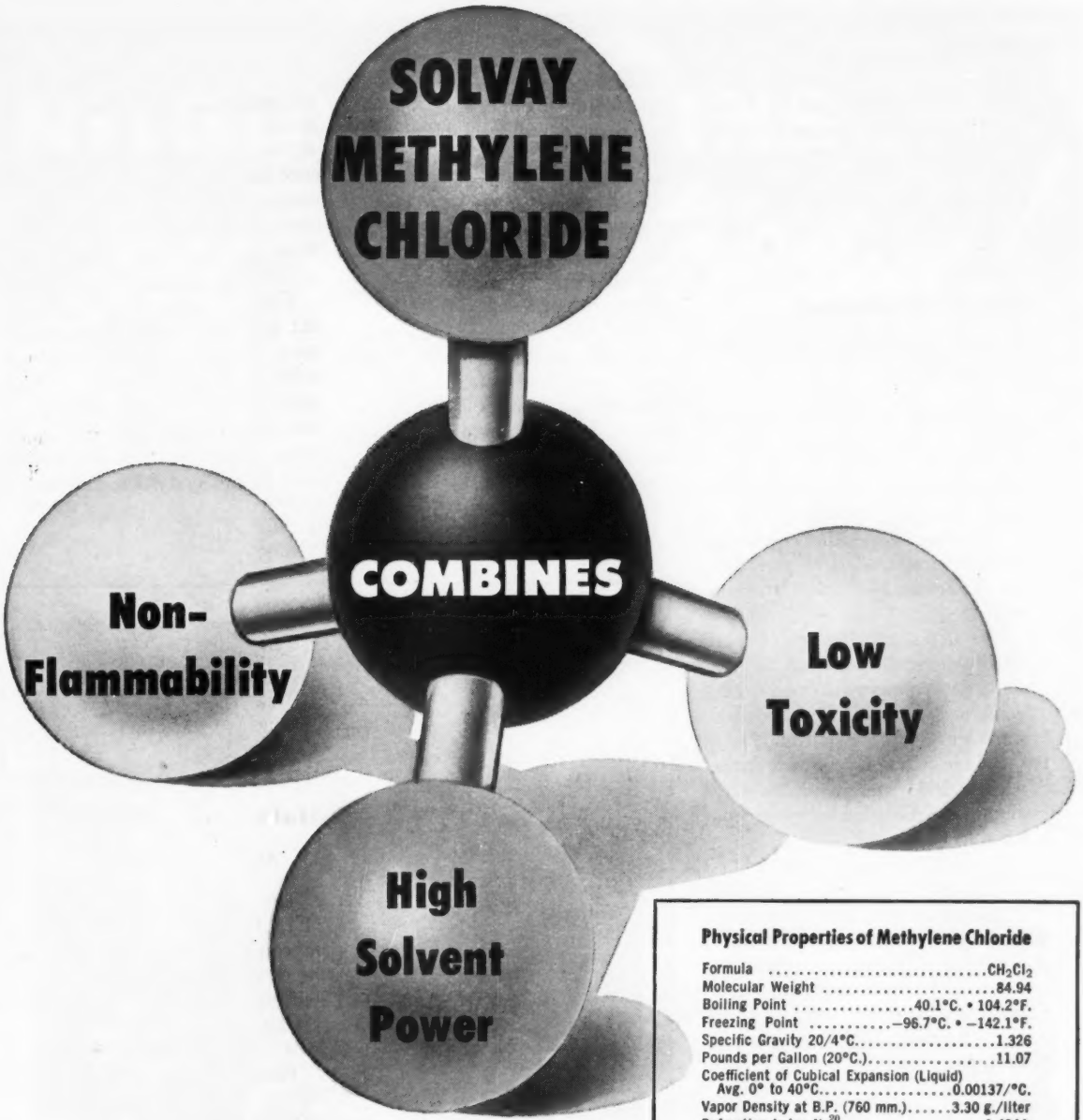
Available in volume.

The diacetal of malonaldehyde (1,1,3,3-tetra alkoxy propane), now in commercial production, should be of special interest as an insolubilizing or cross-linking agent for proteins and/or polyhydroxy materials.

Possessing as it does the versatility of a three carbon dialdehyde with an active methylene group, this new tool for synthesis undergoes many reactions. Reaction with alkyl vinyl ethers yields higher n-alkoxy aliphatic dialdehyde acetals. Malonaldehyde diacetal reacts with substituted anilines to form beta-amino substituted acroleins; with hydrazines to form pyrazoles; and with ureas to produce pyrimidine derivatives.

At present only the mixed (triethyl monomethyl) diacetal of malonaldehyde (TEMP) is available in volume quantities although pilot work is being done on the tetramethyl diacetal (TMP).

TEMP is still tabbed with a development price of $1.80 a lb. However, sustained production will



Combining highly efficient solvent power with the safety of non-flammability and low toxicity, Solvay Methylene Chloride has found many diverse industrial uses such as: the active ingredient in paint remover formulas; an efficient extractant for heat sensitive compounds or organic compounds of a non-polar nature; a solvent and diluent in aerosol packaging; and as a solvent in the manufacture of photographic films and other forms of cellulose acetate.

The coupon will bring you further information or a sample—without cost or obligation.

Physical Properties of Methylene Chloride

Formula	CH_2Cl_2
Molecular Weight	84.94
Boiling Point	40.1°C. • 104.2°F.
Freezing Point	−96.7°C. • −142.1°F.
Specific Gravity 20/4°C.	1.326
Pounds per Gallon (20°C.)	11.07
Coefficient of Cubical Expansion (Liquid) Avg. 0° to 40°C.	0.00137/°C.
Vapor Density at B.P. (760 mm.)	3.30 g./liter
Refractive Index N_D^{20}	1.4244
Viscosity Liquid (20°C.)	0.430 centipoise
Surface Tension (in air) 20°C.	28.12 dynes/cm.
Specific Heat of Liquid (20°C.)	0.284 cal./gm./°C.
Latent Heat of Vaporization (at B. P.)	78.7 cal./gm.
Critical Temperature	245.0°C. • 473.0°F.
Critical Pressure	60.9 atm.
Flash Point	None

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Methyl Chloride • Ortho-dichlorobenzene • Monochlorobenzene
Carbon Tetrachloride • Chloroform • Methylene Chloride

bring prices down—possibly into the $1.25 range or lower. TMP, if manufactured, might offer savings, mole-wise, over TEMP.—**Kay Fries Chemicals, Inc., New York 16, N. Y.** 146D

Calcined Alumina

Higher quality at regular prices.

A calcined alumina with fewer impurities and less water is now available to industry—and at regular commercial prices. R-2003 calcined alumina, produced by a combination Bayer-Sinter process, contains a minimum of such impurities as iron, silicon and titanium oxides.

The new alumina is top ceramic quality designed specifically to contain a minimum of chemically combined water and to absorb only trace quantities of water. Thus, shrinkage is less in products made with R-2003 alumina than with aluminas fired at lower temperatures.

R-2003 alumina is highly resistant to thermal and mechanical shock, and transmits these properties to the finished product containing it. Applications range from abrasives production to use in refractories for lining tanks or furnaces.—**Reynolds Metals Co., Louisville, Ky.** 148A

Waterproof Adhesive

For rapid fabrication of boxboard and paperboard.

Higher production rates for waterproof grades of corrugated or laminated boxboard, paper tubes and bags is now possible thanks to a new alkaline-running waterproof adhesive based on resorcinol. The adhesive possesses the waterproofing qualities of starch-urea-formaldehyde adhesives yet permits the corrugated board production speeds obtainable with conventional starch pastes. (The acidic nature of the older urea-based waterproof adhesives limited the speed with which they could be applied, and the straight starch compounds, though faster, were water soluble.)

Since the new adhesive is compatible with domestic starch pastes, there is no need for washing up the system between waterproof runs. In addition, it is fast curing and develops maximum water resistance immediately.

The resorcinol-based adhesive's cost will be about that of the urea-formaldehyde-starch pastes.—**Koppers Co., Inc., Pittsburgh 19, Pa.; A. E. Staley Mfg. Co., Decatur, Ill.; Penick & Ford, Ltd., Inc., Cedar Rapids, Iowa.** 148B

Radiation Shield

Ferrophosphorus aggregate for concrete simplifies hot cell shielding.

Atomic hot cell installations—room-size chambers in which radioactive materials are worked or handled—need walls thick enough to shield workers and thin enough to permit close supervision, visually and mechanically, of work.

Nearly any dense material qualifies as a good absorber of radiation. But, ordinary concrete and certain

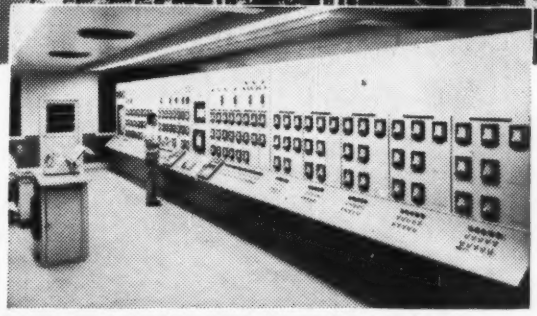
Bull Session

The sidewalk superintendents in the picture above are watching this world's biggest bull—three tons of polyester and steel—get hoisted to the top of a 90-ft. pylon at American Hereford Association headquarters in Kansas City, Mo. "Ferdinand's" skin is fabricated of translucent, glass fiber-reinforced polyester, is strengthened to withstand winds of 110 mph., temperatures from —40 to 120 F. and hailstones (test panels of skin were subjected to a barrage of 100-mph. ice cubes). Internally lighted by more than 700 ft. of cathode tubing, the bull is visible day and night for several miles. A lightning rod is molded into his back, along with two aviation obstruction lights.—Rohm & Haas Co., Philadelphia 5, Pa. 148C

NITROPARAFFINS *on Stream!*

WORLD'S FIRST COMMERCIAL NITROPARAFFIN PLANT NOW IN PRODUCTION

Shipments are now being made from Commercial Solvents Corporation's new plant at Sterlington, Louisiana. Completely designed by CSC engineers, the new plant marks a major step in the company's long-term petrochemical development. The new facilities will produce over 10 million pounds of four basic nitroparaffins – Nitromethane, Nitroethane, 1-Nitropropane, and 2-Nitropropane. In addition, the new plant will turn out multi-million pound quantities of the derivatives listed at right, many of which have achieved outstanding industrial usefulness. This unique family of chemicals opens up entirely new fields with extraordinary potential for all industry.



Control panel contains over 100 miniature recorders and controllers. A unique data reduction unit continually scans and records all operating conditions.

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Nitrohydroxy Compounds

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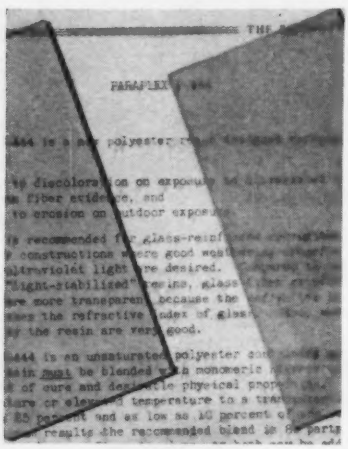
ores have densities of only 150 to 220 lb./cu. ft., would have to be six to eight feet thick for hot shell shielding. Scrap steel, shot and steel punchings produce dense enough concrete but tend to segregate in mixing and, in some instances, have rusted.

Ferrophosphorus, however, produced a concrete density of 290-300 lb./cu. ft., showed excellent workability and no segregation, and did not rust.–**Victor Chemical Works, Chicago 6, Ill. 148D**



Clearer Polyester

Resists ultraviolet light and weathering.

Greater transparency in glass fiber-reinforced laminates is obtainable through use of Paraplex P-444, a new polyester resin, than with conventional resins (see cut). In blends with styrene monomer or vinyl toluene, P-444 has, when cured, a refractive index of 1.546 compared with glass at 1.548.

Paraplex P-444 resists discoloration by ultraviolet light and outdoor erosion. Its laminates show little visible evidence of the glass fiber reinforcement. P-444 is thus especially recommended for glass reinforced corrugated panels, flat sheet, awnings or other constructions which require good weathering properties.

An unsaturated polyester containing monomeric methyl methacrylate, P-444 must be blended with styrene and vinyl toluene to obtain adequate curing speed and desirable physical properties. Optimum ratio: 80 parts P-444 to 20 parts monomer.–**Rohm & Haas Co., Philadelphia 5, Pa. 150A**

BRIEFS

A refrigerant-resistant compound is now on the market which, when used for seals and mechanical parts, limits swelling and volume change. Compound 1242 stands up to Freon 12, 13, 22, 31, 32, 114, 115, 218; to C-316 and C-318; and to propane, butane, pentane, methyl chloride and methylene chloride. – **Goshen Rubber Co., Goshen, Ind. 150B**

Super-purity aluminum pig–with 99.99% or more aluminum–is available in volume quantity from a domestic source. Most high purity aluminum has been imported before this. Important applications are: catalysts for the chemical and petroleum industries; and capacitors (in foil form) for electronic, radio and TV equipment.–**Kaiser Aluminum & Chemical Corp., Oakland 12, Calif. 150C**

Pelleted zinc oxide will be welcomed by the rubber manufacturer. He can weigh Protex-267 quicker, pour it faster, mix it more rapidly with less power, and leave less waste in the emptied bag. Protex-267 packs more densely, takes only one-third the space of conventional zinc oxide.–**New Jersey Zinc Co., New York 38, N. Y. 150D**

Antisoiler promotion is being stepped up with the appearance on the market of a non-silica carpet treating compound, Cyana Soil Retardant. Similar in effect to Du Pont's Ludox colloidal silica announced just recently, Cyana slows the soiling of rugs by filling in the roughness of fibers with a finely divided material, keeps surfaces clean up to five times longer than when untreated. Antisoilers like Ludox and Cyana will move soon into applications for other pile fabrics, flat fabrics, wallpaper, painted walls, etc.–**American Cyanamid Co., New York 20, N. Y. 150E**

A "slow release" nitrogen fertilizer, Borden's 38, is Borden's first entry in the chemical fertilizer field. Containing 38% nitrogen, with no phosphorus or potash added, the fertilizer is non-burning and will release nitrogen steadily for periods ranging from six months to a year. Fifteen to 18 lb. will serve a 1,000 sq. ft. area of turfgrass for a full season.–**Borden Co., New York 17, N. Y. 150F**

Carbon black fillers for silicone rubber–in place of conventional silicas–can now provide satisfactory reinforcement thanks to Linde W-96 Silicone, a new type of gum stock featuring controlled reactivity. Carbon black-filled silicone rubbers compare favorably with silica-filled rubber on the basis of such quality standards as hardness, tensile strength, elongation, compression set and brittle point.–**Linde Air Products Co., New York 17, N. Y. 150G**

A surfactant for textile processing that combines advantages of both anionic soap and nonionic detergents is Sandopan DTC. The new surfactant saves bleaching material and gives a faster, more uniform bleach; removes oil and graphite from synthetics; increases abrasion resistance and crease retention of resin finished goods; and permits faster desizing.–**Sandoz Chemical Works, Inc., New York 13, N. Y. 150H**

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CHEMICAL ENGINEERING NEWS

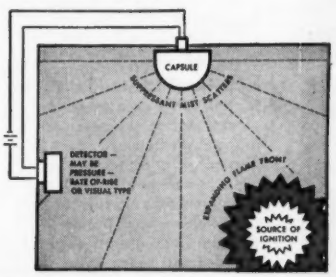
PROPERTY AND APPLICATION DATA ON THESE VERSATILE ENGINEERING MATERIALS: "ZYTEL," "ALATHON," "TEFLON," "LUCITE."

Fire- and explosion-suppression systems use Du Pont "Zytel" for bellows and capsule

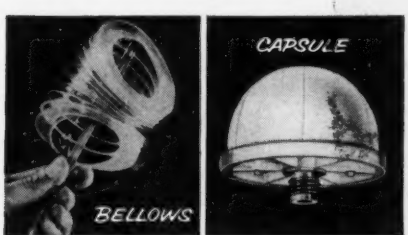
The heart of a new-type explosion- and fire-suppression device is a bellows made of "Zytel" nylon resin. The device is mounted inside containers or compartments which hold combustible materials. A typical application is its use in fuel storage tanks. Should the explosive fuel-air mixture become ignited, the resulting rise in pressure compresses the "Zytel" bellows. The action fires a detonator releasing a suppressive liquid that stops the pressure rise before destruction of the tank occurs.

Lightweight "Zytel" is specified for this application because its chemical resistance and flexibility in thin sections supply the type of performance necessary for satisfactory operation of the bellows.

"Zytel" is also used to mold the capsule which holds the suppressive liquid. This is because the capsule must not only resist corrosion, but be lightweight and economical to manufacture.

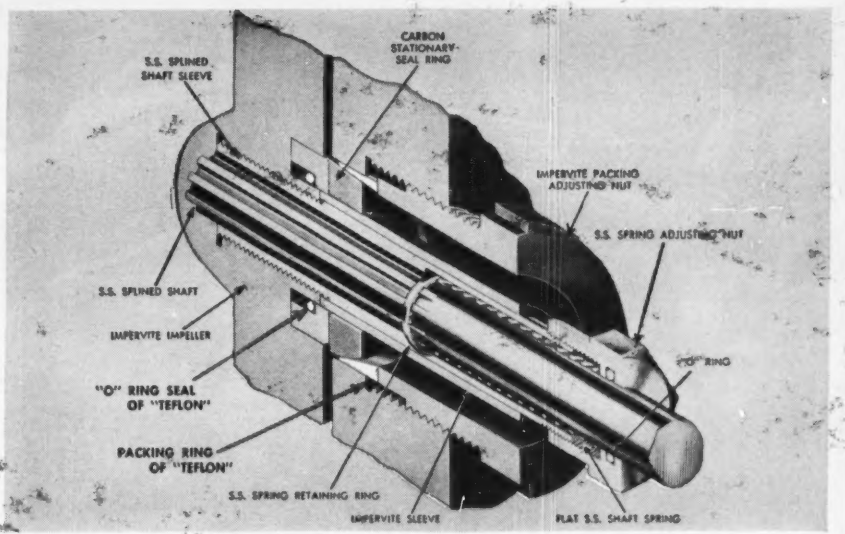

CAPSULE
SUPPRESSANT MIST SCATTERS
DETECTOR – MAY BE PRESSURE – RATE OF RISE OR VISUAL TYPE
EXPANDING FLAME FRONT
SOURCE OF IGNITION

How the explosion- and fire-suppression system works. Pressure occurring milliseconds before an explosion extends a bellows of Du Pont "Zytel" nylon resin, which detonates a device to release the suppressant.



Capsule and bellows of "Zytel." These parts are produced economically, resist corrosion, have remarkable strength. (Bellows is produced for Simmonds Aerocessories, Inc., Tarrytown, New York, by Plastex Process Company, Maywood, N. J.

Du Pont "Zytel" may be just the material you need to solve a design or operating problem. For complete data on this engineering material—property tables, typical applications, production techniques—use the coupon on the right of this page.



Cutaway view of Impervite pump manufactured by Falls Industries, Inc., Solon, Ohio. Parts of "Teflon" fabricated by Shamban Engineering Company, Culver City, California.

O-ring seals and packing rings of TEFLON® handle corrosive fluids in large volume

Fabricated into O-ring seals and packing rings, Du Pont "Teflon" is used to improve the design and efficiency of this single-stage centrifugal pump. With "Teflon" the pump can handle corrosive fluids over a wide temperature range. "Teflon" helps assure leak-proof performance. The low coefficient of friction and self-lubricating properties of "Teflon" reduce wear of the O-ring. With O-rings and packing rings of "Teflon," a minimum of maintenance is assured. Because "Teflon" is chemically inert, corrosives can be used in contact with packing ring to make the pump seal self-cooling.

"Teflon" has established a remarkable record for dependable service in scores of industries. Can its wide range of properties benefit your operation? Clip and mail the coupon below for complete property and application data.

NEED MORE INFORMATION?

CLIP THE COUPON for additional data on the properties and applications of these Du Pont engineering materials.

• "Teflon," "Alathon," "Zytel" and "Lucite" are registered trade-marks of E. I. du Pont de Nemours & Co. (Inc.).

E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department, Room 2511, Du Pont Building, Wilmington 98, Delaware
In Canada: Du Pont Company of Canada Limited, P.O. Box 660, Montreal, Quebec.

Please send me more information on the Du Pont engineering materials checked: ☐ "Teflon"* tetrafluoroethylene resin; ☐ "Alathon"* polyethylene resin; ☐ "Zytel"* nylon resin; ☐ "Lucite"* acrylic resin. I am interested in evaluating these materials for_____

NAME_____

COMPANY_____ POSITION_____

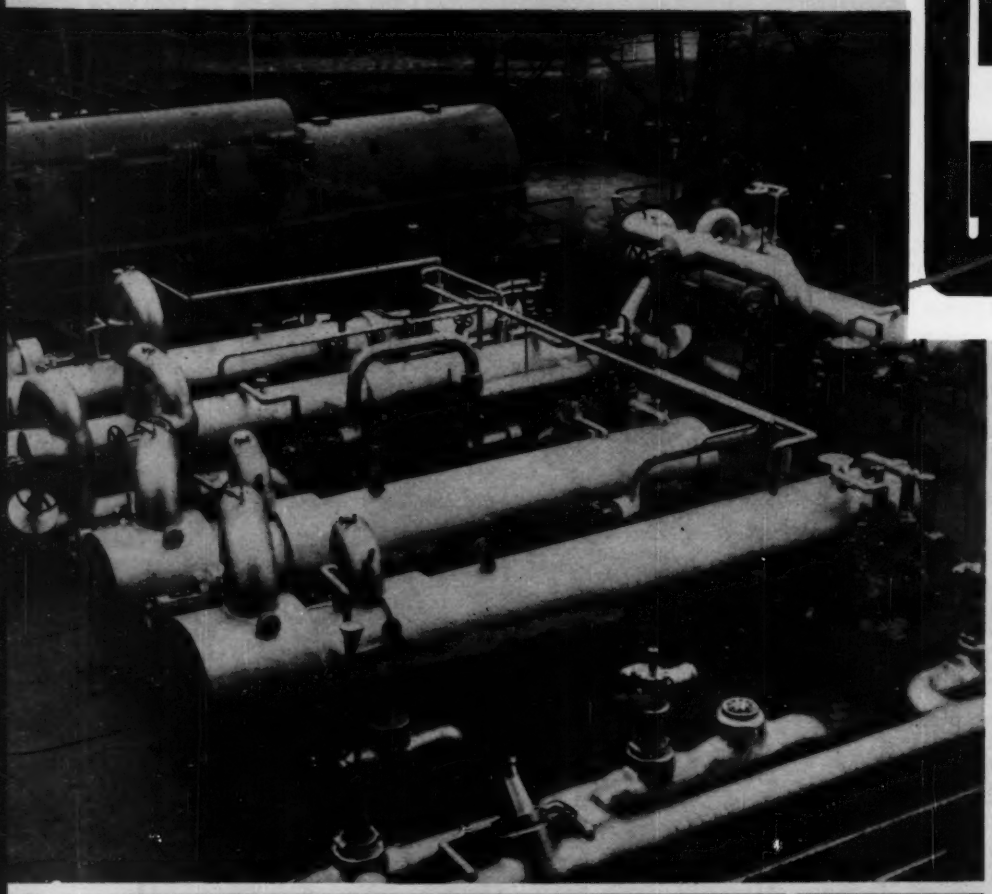
STREET_____

CITY_____ STATE_____

TYPE OF BUSINESS_____

One of a series telling
how the producing companies of
General Precision Equipment Corporation
are contributing to America's progress.

GPE



Griscom-Russell feed water heaters in a 125,000 KW public-utility power station; save nearly 100 tons of coal per day. Heaters handle flow of water exceeding 2000 G.P.M. at 2500 pounds pressure and steam extracted from the turbine at five different points; "train" of five units pre-heats water fed to boilers from 90° F. to 441° F.

Askania multiple fuel boiler control panel in large steel plant; maintains metered proportion between combustion air and fuels—coke oven gas and fuel oil—for most economical combustion; holds steam pressure constant through all load changes and keeps furnace pressure at a safe and predetermined value.

General Precision Laboratory's Industrial TV Camera, the "Bullet"; portable, easily operated; used to monitor and improve manufacturing processes and to view hazardous industrial operations.

The highly advanced technological products designed and manufactured by the eighteen producing companies of General Precision Equipment Corporation serve more than a dozen major industries. Products of six of these GPE Companies—Griscom-Russell, Askania, Librascope, Link, Kearfott and General Precision Laboratory—have widespread application in the processing and power industries.

Industrial Processing...and Power

The Griscom-Russell Company is one of the country's largest producers in the fields of heat exchange and water distillation. It is the pioneer in heat exchanger equipment—the key to the whole complex of modern industrial processing and power. For over seventy years, G-R equipment has been responsible for greatly increased efficiency and lowered operating costs in industry.

Askania Regulator Company for a quarter of a century has been a leading developer in the field of regulators and controls, including components and systems. Its products are widely used by the power, steel, gas and coke, mining, chemical, petroleum, glass and paper industries—wherever great reliability and accuracy are essential.

Kearfott Company, Inc.; Librascope, Incorporated; and Link Aviation, Inc. produce a wide variety of precision instruments, computers, servos and other control components for equipment and systems used throughout the power and the processing industries. Industrial television equipment manufactured by General Precision Laboratory Incorporated, the sixth GPE Company active in these fields, is playing increasingly important roles in "seeing eye" monitoring operations in these industries.

Each company in the GPE Group works in specific, highly specialized technical areas, as indicated in the chart below. Each of these companies, in addition to specializing in its particular products and fields of technical competence, has at its command, as required, the facilities and specialized techniques of the other GPE Companies in their respective fields. Interrelation is achieved through GPE's basic operating policy, Coordinated Precision Technology.

In the fields of research and development, GPE Coordinated Precision Technology permits a high degree of specialization in particular areas of competence and supplements such specialization by the application of techniques in other fields, as desirable. In the field of production, it makes possible a highly flexible application of facilities. This policy has been responsible for a diversified line of precision equipment of superior design and performance, covering a wide range of both standard and special uses.

Perhaps the most conspicuous advantage of GPE Coordinated Precision Technology is that the concept and development of equipment, and of solutions to the underlying technical problems, are not restricted or distorted by traditional allegiance to specialization in a particular field. GPE coordination permits the engineers and technical personnel of each GPE Company to seek the optimum solution for the customer within the total capacities of the GPE Companies as a group.

● Manufacturing
●● Manufacturing and product development
●●● Manufacturing, product development and research
□●●● Pilot manufacturing, product development and research

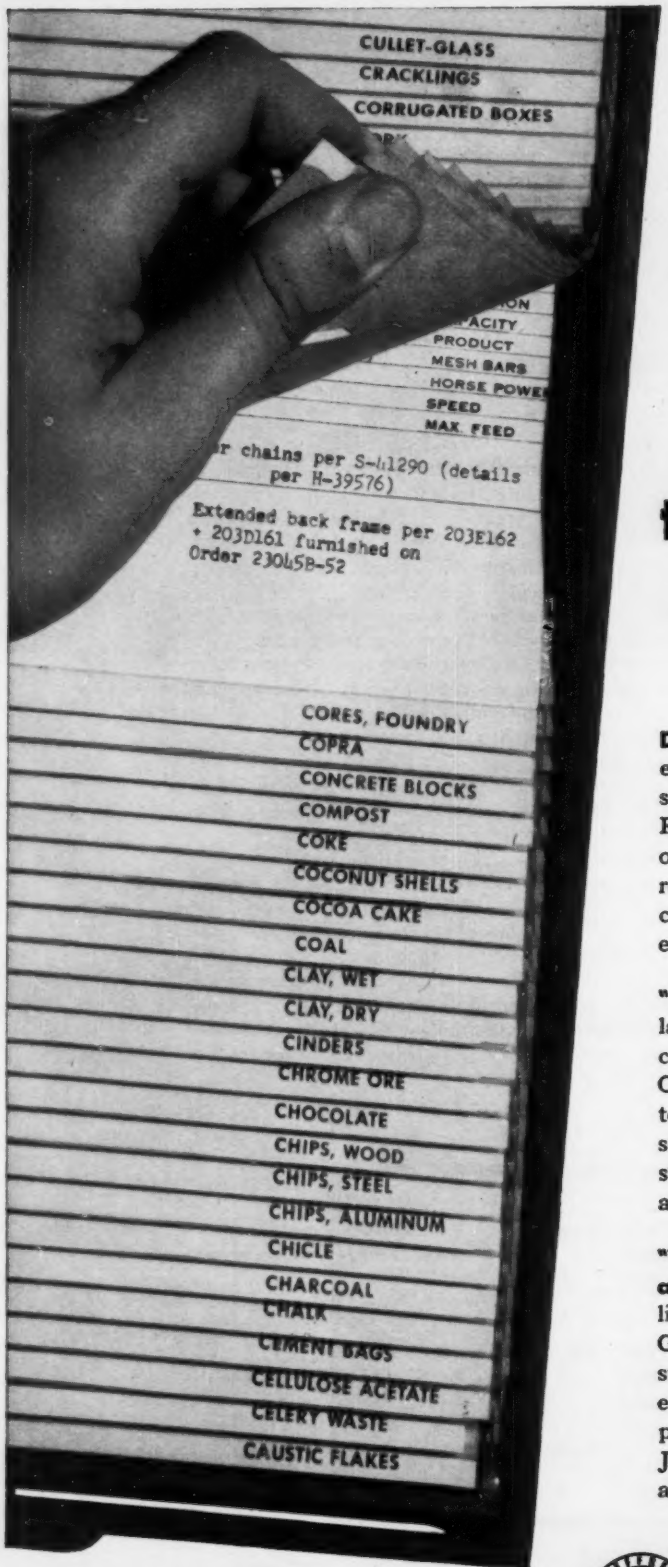
KEARFOTT COMPANY, INC.	INTERNATIONAL PRODUCTION CORPORATION	BLUDWORTH MARINE DIVISION	GENERAL PRECISION LABORATORY INCORPORATED	THE GRISCOM-RUSSELL COMPANY	LINK AVIATION, INC.	THE HEIRTNER ELECTRIC COMPANY	THE STRONG ELECTRIC CORPORATION	J. E. McAULEY MFG. CO.	ASKANIA REGULATOR COMPANY	AMPRO CORPORATION	LIBRASCOPE, INCORPORATED	
●●●	●●	●●	□●●●	●●	●●●	●●	●●●	●●	●●	●●	●●●	PRECISION MECHANICS, OPTICAL DEVICES, CERAMICS
●●●	●	●			●●●	●●●	●●	●	●●	●	●●●	ELECTRICAL EQUIPMENT and COMPONENTS
●●●	●●	●●●	●●●		●●●	●	●●		●●●	●●	●●●	ELECTRONICS
	●●			●●●					●●●			HYDRAULICS, LIQUIDS PROCESSING, HEAT EXCHANGE
●	●		●●●		●				●			TELEVISION Studio, Theatre, Educational, Business, Industrial
●●●	●	●●	□●●●		●●●	●●	●●		●●●	●	●●●	INSTRUMENTS, SERVOS, CONTROLS Hydraulic, Pneumatic, Magnetic, Electronic
●●●	●		●●●		●●●	●			●●	●	●●●	AIRCRAFT and MISSILE GUIDANCE, CONTROL, SIMULATION
●●●	●	●	□●●●		●●●				●●●		●●●	AUTOMATIC COMPUTERS and COMPONENTS
●●●	●	●●	●●●		●●		●		●			RADAR, MICROWAVE, ULTRASONICS
	●●●		□●●●			●●	●●●	●●●		●●●		MOTION PICTURE and AUDIO EQUIPMENT
●●●				●●					●●		●●●	NUCLEAR POWER COMPONENTS and CONTROLS
●●●			●●●	●●●	●●●				●●●		●●●	SYSTEMS ENGINEERING Aeronautical, Naval, Industrial

THE GPE PRODUCING COMPANIES

A brochure relative to GPE Coordinated Precision Technology and the work of the GPE Companies is available. Address your request, or inquiries on specific problems, to:

General Precision Equipment Corporation

92 GOLD STREET, NEW YORK 38, NEW YORK



"what type of Crusher, Pulverizer, Shredder or Grinder do we need?"

you'll find the answers here in Jeffrey's files

During the past 60 years, Jeffrey reduction equipment has handled almost every conceivable substance, including many you'd never imagine. Our Reduction Engineers have in their files the history of all tests run on these materials, plus performance records on the machines sold for their reduction. You can check with Jeffrey and make sure of reduction equipment performance *before* you sign the order.

"But my product's new." Jeffrey's modern testing laboratory is completely equipped to determine the correct type and size of machine for a given task. Only a small amount of material is required for testing. You may witness the experiments, and results are held in strict confidence. All tests using standard equipment are made without charge to a customer.

"What machine will give us maximum efficiency and economy of operation?" The long, complete line of Jeffrey Crushers, Pulverizers, Shredders and Grinders enables us to give you the machine best suited to your specific needs. In most cases, standard equipment is recommended, with special internal parts where they are necessary. You can count on Jeffrey engineers to give you reliable and unbiased advice on crushing problems.

There is no substitute for know-how. *An outline of your reduction problems is all we need to submit recommendations. Write The Jeffrey Manufacturing Company, Columbus 16, Ohio.*

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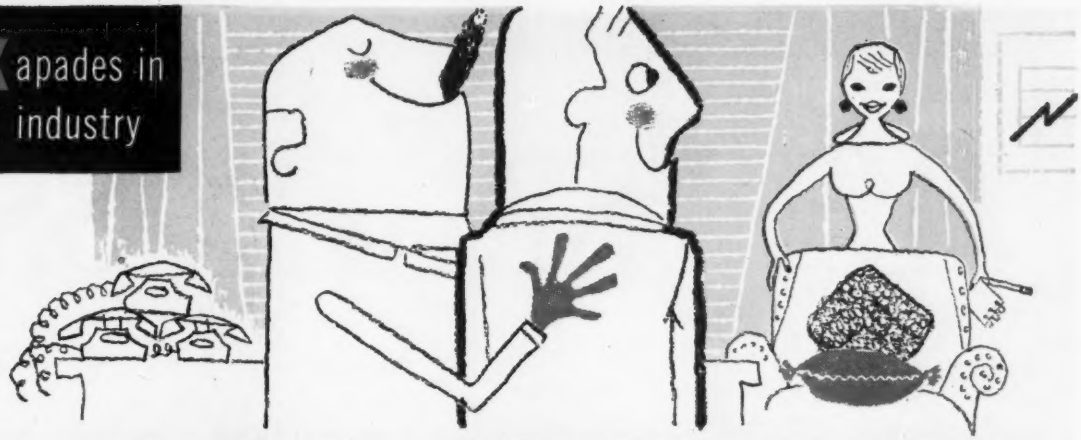
S/K apades in industry

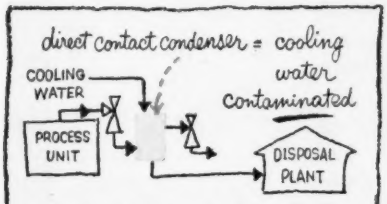


THE CASE OF THE CONTAMINATED WATER AND THE PLANT THAT COULDN'T EXPAND

A plush, private office and a beauteous secretary for Wilmer, the newly created Big Wheel!

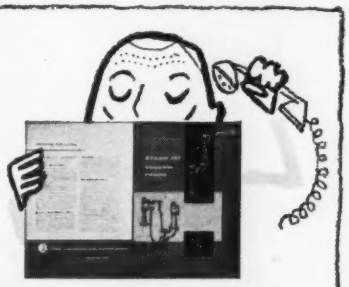
Wilmer found a way to blitz a waste disposal jinx that was road-blocking plant expansion.

Top Brass at the chemical plant where Wilmer worked wanted to add new vacuum processing units. But that meant more waste—and the disposal plant was already operating near capacity. Also, direct contact type condensers, used in the two-stage steam jet vacuum pumps, contaminated all cooling water and added to the volume of waste.



PUZZLE: how to expand without increasing the capacity of the disposal plant or exceeding the legal amount of waste that could be dumped into streams.

Wilmer didn't dawdle—he doodled. His sketch of the existing vacuum pump installation looked like this. Eliminate contamination of cooling water and there'd be far less waste to get rid of. But how?



Schutte and Koerting new Bulletin 5-H2 on "Two-Stage Steam Jet Vacuum Pumps" suggested an answer. Surface condensers in place of the direct contact units would end contamination of cooling water. Wilmer picked up the phone and called the nearest SK Sales Engineer.

The SK Engineer arrived on the double. He took a close look at the situation and promptly worked out design details for replacing direct condensers with surface condensers—on units already installed.

PLANT EXPANSION ACCOMPLISHED . . . WITHOUT DELAY.
With cooling water being recirculated instead of discharged to stream, the waste disposal plant is not overloaded. Additional process units have been installed with new SK stainless steel vacuum pumps. And Wilmer is sitting pretty in his new job.

MORAL:

Send for your copy of new Bulletin 5-H2 containing technical data on two-stage units—part of SK's complete line of steam jet vacuum pumps. And be sure to call a qualified specialist on jet apparatus—your SK Sales Engineer—on any problem that needles you.

Schutte and Koerting
COMPANY
MANUFACTURING ENGINEERS
2217 STATE ROAD, CORNWELLS HEIGHTS, BUCKS COUNTY, PA.

Jet Apparatus • Heat Transfer Equipment
Strainers • Condensers and Vacuum Pumps
Oil Burning Equipment • Rotameters
Flow Indicators • Radiation Tubes • Valves
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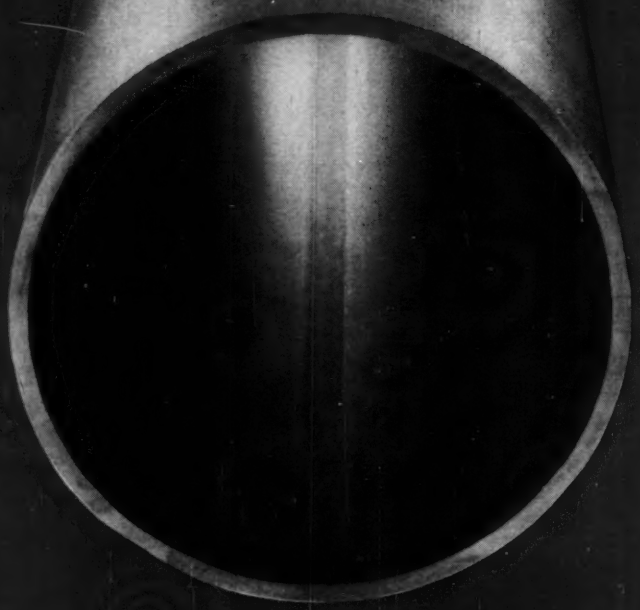
Desuperheaters

announcing

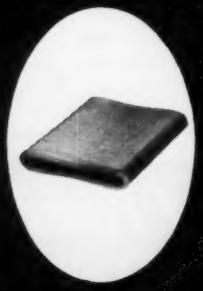
new stainless



CONTOUR-WELD PIPE . . . BEST BY ANY TEST YOU CAN NAME

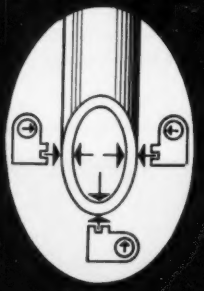
Reverse Bend
(2 3/8" O D x .154 wall)

Flare and Flange



Flattening

Pressure (Tubing)



Uniformity

welded pipe

. . . with smooth inside surface free from bead or undercut . . .

Now you can get any gage TRENTWELD stainless pipe or tubing with a smoother inside surface than ever before – free from any undercut or projecting bead. Here's why . . .

With their new, patented, *Contour-Weld** process, Trent puts gravity to work. Molten metal in the weld zone is always pulled down by gravity – but, in *Contour-Welding*, the weld's at the bottom. As molten metal is pulled downward . . . held together by surface tension . . . it forms itself into the inner contour of the pipe, rather than taking the opposite curvature as happens when welding is done at the top.

What Contour-Weld means to You

Because Trent has always used uniformly rolled stainless strip, Trent pipe and tubing have long been known for extremely high uniformity both of wall thickness and curvature. *Contour-Welding* extends that uniformity to the weld zone itself. There's no projecting weld bead . . . no undercut. Flanged or flared ends are smoother, too . . . cavitation corrosion or erosion are completely eliminated. By every test, Trent *Contour-Welded* pipe outperforms any other pipe or tubing.

Test this exclusive new TRENTWELD stainless pipe or tubing yourself. You'll find it's ideal for any application, including such demanding ones as high pressure hydraulic lines . . . lines carrying corrosive chemicals . . . high-velocity systems. And use *Contour-Welded* pipe and tubing with confidence, for it's made by Trent – tube mill specialists.

Why Trent's Exclusive Contour-Weld *Process means smoother welds . . .*

Here's the conventional way of welding pipe. Gravity pulls some of the molten metal down into the pipe to form a bead that is extremely difficult to remove by cold working. The cold working of the inside bead can lead to undercuts, focal points for erosive and corrosive attack. Cleaning is difficult.

Trent couldn't repeal gravity, so they put gravity to work. They flopped the pipe over, and made the weld at the bottom. Gravity still pulls the molten metal down — but, in doing so, it simply makes the weld bead contour correspond to the contour of the pipe itself. That's why there's no telltale bulge of weld metal on the critical inside pipe surface. And, even on the outside surface, the weld-bead contour more closely approaches that of the parent metal than any other welded pipe.

*Contour-Weld is the trade mark of the Trent Tube Co. for its process of welding pipe and tubing which is protected under U.S. Patent 2,716,692.

TRENTWELD **STAINLESS STEEL TUBING**

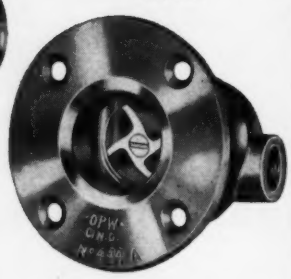
TRENT TUBE COMPANY, GENERAL SALES OFFICES, EAST TROY, WISCONSIN (Subsidiary of CRUCIBLE STEEL COMPANY OF AMERICA)

Takes ONE LOOK to Really Know . . .

with OPW VISI-FLO

No. 45

No. 44



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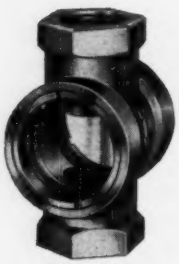

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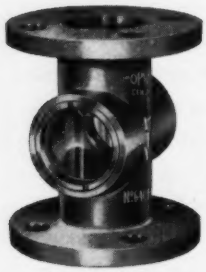

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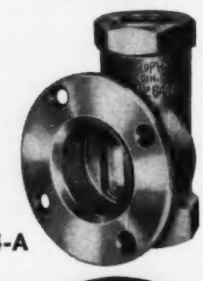

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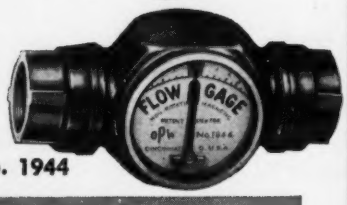

No. 1944

It's important to know at all times—what's going on . . . as well as what's going through !

You'll find OPW "VISI-FLO" Sight Glass Indicators a trustworthy visible means of alerting you as to rate of flow, viscosity, color of liquids, clarity and purity of product.

Whether it's entrained solids, gasoline, oil, water or even orange juice . . . "VISI-FLO" accurately shows you . . . helps you to insure protection against line stoppage . . . helps maintain uniformity, a high standard of product quality, and an even continuity of production.

From plain type to magnetic indicating type, the complete "VISI-FLO" line represents every application possible—vertical, horizontal, screwed end, flange type, with or without propeller. Manufactured in types for application to exposed pipes or for predesigned liquid channels incorporated in the machine.

Write for FREE BULLETIN F-6, for full information, sizes, styles and engineering specifications.

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TOP HANDLING HAZARDOUS LIQUIDS
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VALVES • FITTINGS • ASSEMBLIES
CINCINNATI 25, OHIO

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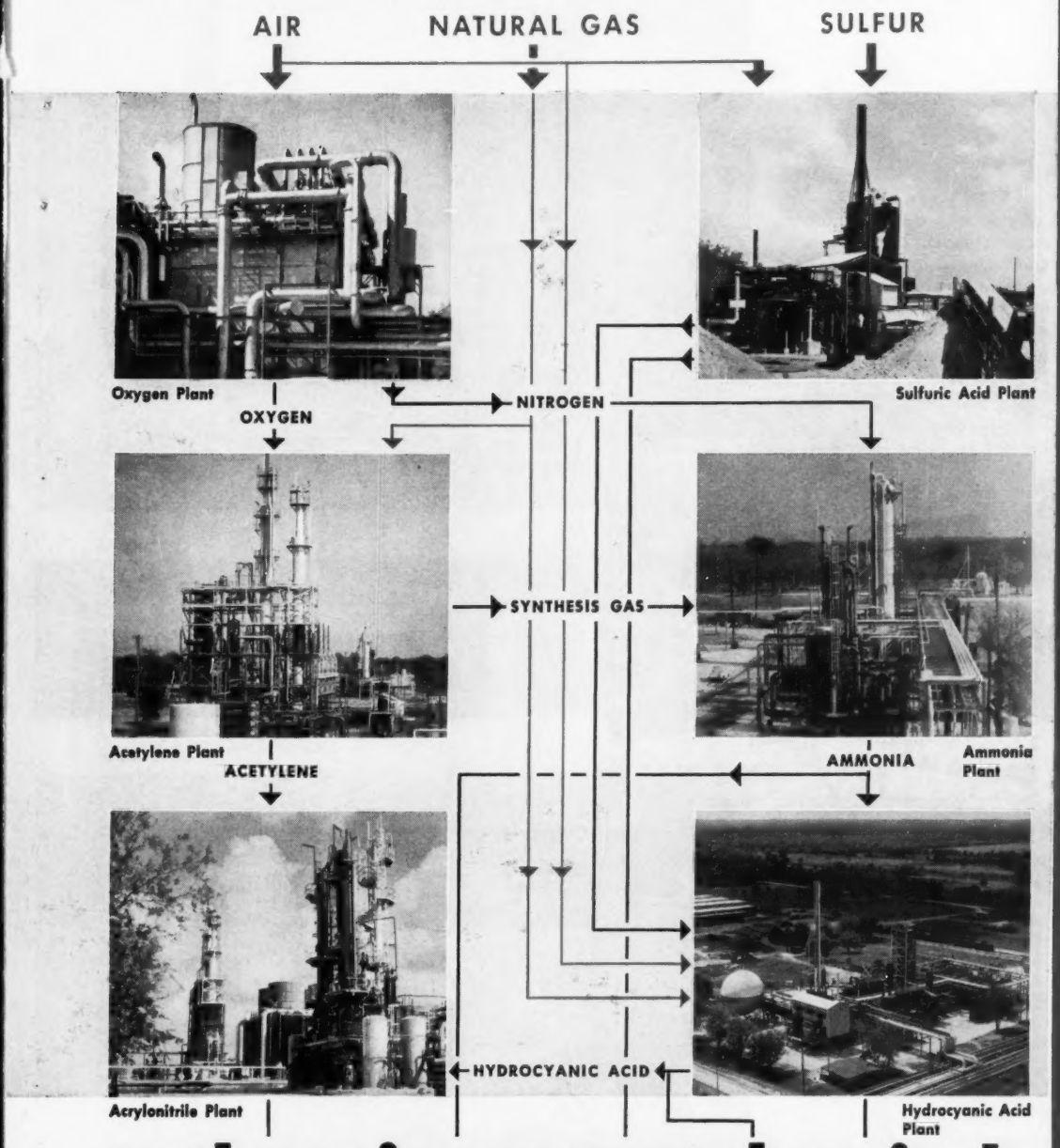
From these raw materials...



to these important chemicals

ACRYLO-NITRILE	AMMONIA	SULFURIC ACID	HYDRO-CYANIC ACID	AMMONIUM SULFATE

The Fortier Plant of American Cyanamid Company, Avondale, Louisiana, designed and constructed by CHEMICO

CHEMICAL CONSTRUCTION CORPORATION

A UNIT OF AMERICAN CYANAMID COMPANY

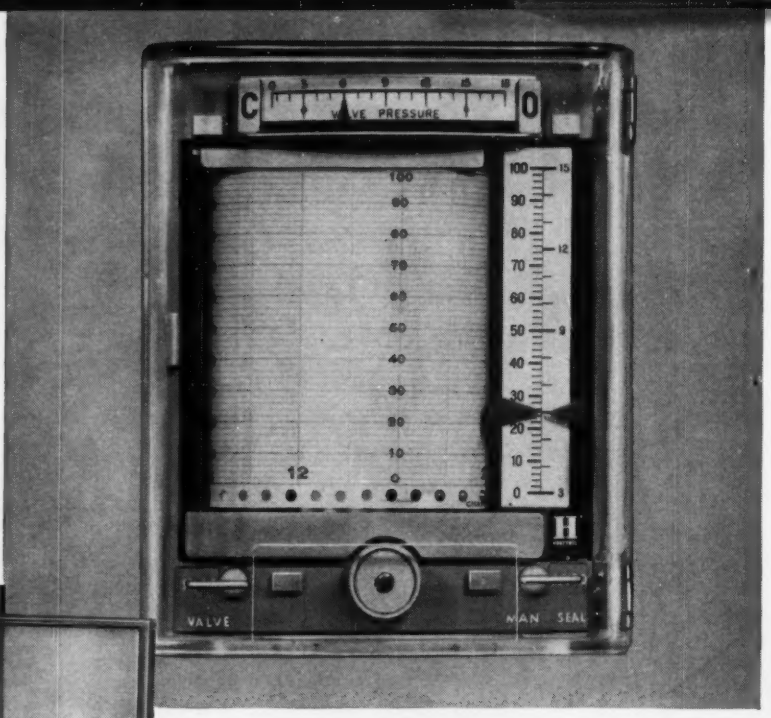
525 WEST 43RD STREET, NEW YORK 36, NEW YORK

Cable Address: Chemiconst, New York • Technical Representatives: Cyanamid Products Ltd, London South African Cyanamid (Pty) Ltd., Johannesburg

CC-283

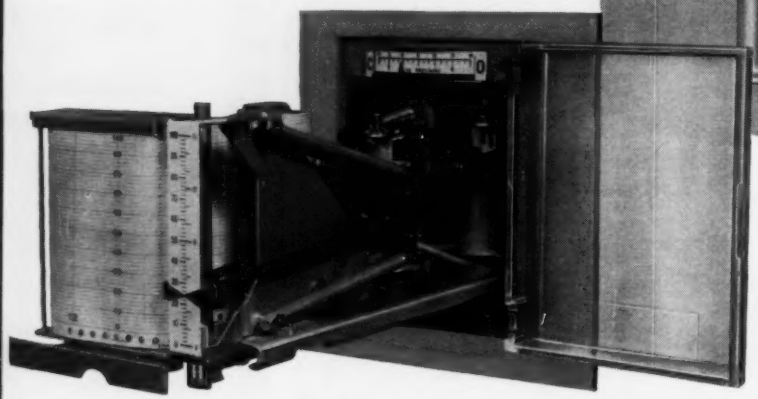
CHEMICO

CHEMICO CHEMICAL CONSTRUCTION CORPORATION

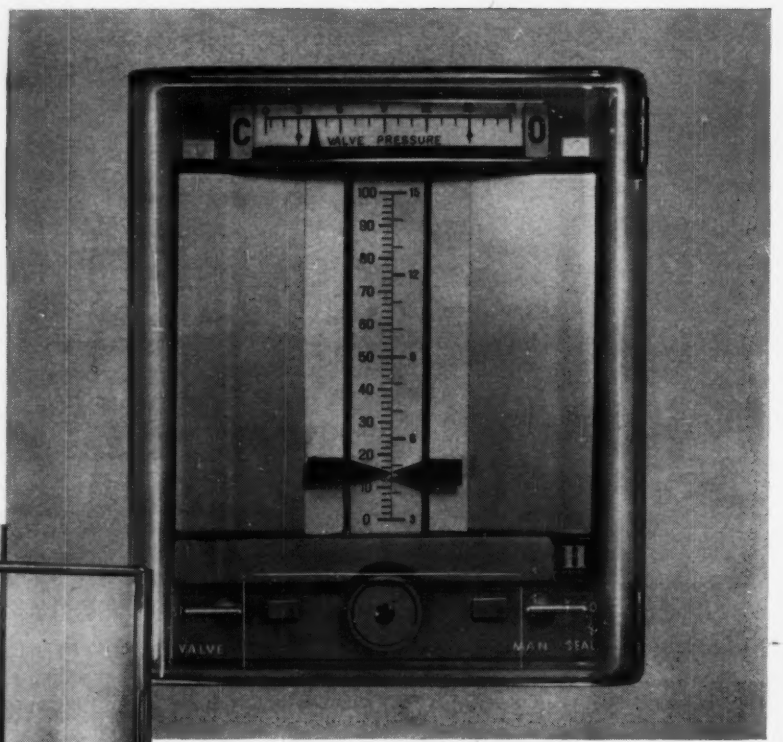


TEL-O-SET RECORDER

takes panel cut-out only 5-1/32" high by 4-9/16" wide. Chassis slides out of case as a complete unit . . . can be shipped separately to prevent damage and collection of dirt or dust awaiting start-up. In partially withdrawn position, the internal mechanism is accessible for adjustments. Uses identical case as indicator. Bottom-of-case location of control knobs permits instrument to be mounted higher on the panel.

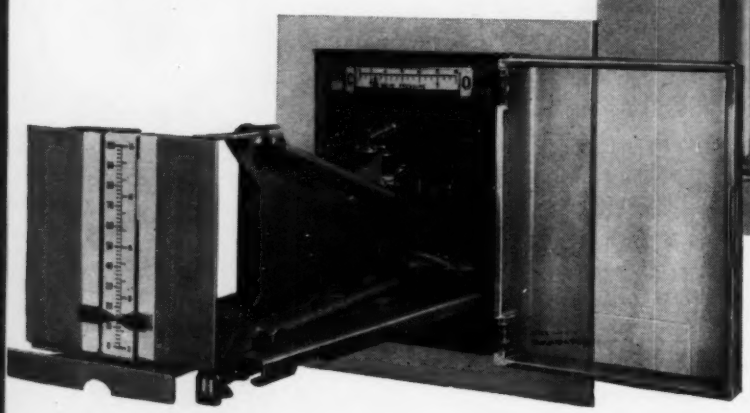


today's



NEW TEL-O-SET INDICATOR

takes same panel cut-out as recorder . . . uses many of the same parts. Less spare parts inventory is required. Note the rugged construction, easily accessible calibration adjustments. Vertical scale makes it easy to compare set point and measured value. Recorder and indicator chassis are completely interchangeable.



● **REFERENCE DATA:** Write for new Bulletin No. 7202.

In performance . . .

precision . . .

serviceability . . .

Tel-O-Set instruments

give you extra values

Whenever you're planning graphic process control, plan to take advantage of the extra values built into the latest *Tel-O-Set* miniature instruments. These advanced indicators, recorders and controllers simplify installation, service and replacement problems . . . and give you the top in accurate, flexible performance for controlling temperature, flow, pressure and liquid level.

Installation is easier. Case, chassis and controller are separate units. The case can be shipped separately to the point of installation and fully piped and tested . . . for the air to valve gage, regulator and switch assembly remain with the case. These components are readily removed without need for breaking conduit or electrical connections. Panel shipment is simplified, with chassis and controller going directly to the job.

Service is easier. All major parts of the indicator and recorder are identical and interchangeable. Unitized construction of sub-assemblies permits interchangeability of sections of major assemblies. The chassis can be partially or fully withdrawn and remain completely operative. It can be disconnected without losing manual control. Controllers have single-lever, quick-disconnect switch . . . use simple, gasketed, flat, mating surfaces.

Operation is easier. An integral switch provides external reset feedback, air on automatic position or air on manual position of bypass relay . . . permitting use with any force-balance controller of past or present design. Opposing pointers tell the measured value and set point on prominently marked vertical scales. Control knob and transfer switch are conveniently located at the bottom of the case, where the operator can manipulate them without having his hand obscure vision of the pointers and scale.

Precision is high . . . ample for even the most exacting process requirements, with true linear calibration.

For a discussion of applications to your own processes, call your local Honeywell sales engineer . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

Here's a real acid test!

3,000 feet of U. S. Uscolite Pipe unharmed after 2 years' steady drinking of acid

Section of three U.S. Uscolite Pipes in color mixing section of wallpaper plant. The pipes carry corrosive solution for fixing the print on wallpaper.

Uscolite pipe and fittings are made in the broadest and largest line of stock sizes on the market. Sizes run from ½" to 6".

A wallpaper plant in Illinois changed ideas about piping when U.S. Uscolite® Pipe was installed in the two pipe lines that handle corrosive materials. (One line handles a corrosive solution used to fix the print on the wallpaper; the other handles 10% hydrochloric acid dye solution.)

Before Uscolite was put in, the piping in the plant lasted about 3½ years. But U.S. Uscolite, 3,000 feet in all, has so far been on the job 4 years—with no deterioration whatever. Moreover, the Uscolite piping is exposed to accidental knocks and physical abuse all along the line, yet its high impact strength protects it from harm. Based on its present performance, it looks like it will last for years and years.

A product of United States Rubber Company, Uscolite piping is, despite its strength, very light in weight. It resists, inside and out, the corrosive action of acids, salts, alkalies and fumes. A complete line of pipe, fittings and Uscolite (Hills-McCanna) valves is available for any and all piping problems.

Rid yourself of any problems in carrying corrosive materials; get in touch with any of our selected distributors, or any of the 27 "U.S." District Sales Offices, or write address below.

"U.S." Research perfects it..."U.S." Production builds it...U.S. Industry depends on it.

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION · ROCKEFELLER CENTER, NEW YORK 20, N.Y.

Hose • Belting • Expansion Joints • Rubber-to-metal Products • Oil Field Specialties • Plastic Pipe and Fittings • Grinding Wheels • Packings • Tapes Molded and Extruded Rubber and Plastic Products • Protective Linings and Coatings • Conductive Rubber • Adhesives • Roll Coverings • Mats and Matting

You get more than a mixer at

SPROUT-WALDRON

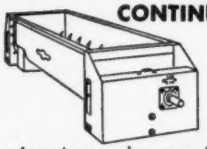
You get many *plus* values when you deal with Sprout-Waldron. In mixers, you get a wide choice of styles and sizes—models for the gentle handling of delicate materials or models for severe action on heavy, dense substances. Every model can be tailored to fit your needs by Sprout-Waldron's unique "adaptioneering" methods.

You also get reliable guidance on installations and applications from our engineering representatives and engineering staff, who are thoroughly experienced in solving mixing problems for the processing industries.

Ollie Morgan

Typical of the Sprout-Waldron representatives is Ollie Morgan, pictured here, an engineering graduate of Penn State. Before joining Sprout-Waldron, he worked as a sales engineer for Wallace & Tiernan, handling scales, feeders, and associated equipment. His helpful suggestions to solve processing problems are well known to his many customers. With such men to help you, you're bound to buy *right* at Sprout-Waldron.

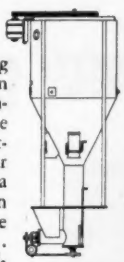
SPROUT-WALDRON CONTINUOUS MIXERS



Double Agitator

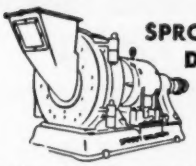
Ideal for adding hot or cold liquids, viscous or otherwise, to dry materials...for blending two or more materials...for mixing thin and dense slurries...for blending products from holding bins to assure uniformity of large shipments...all on a continuous basis.

SPROUT-WALDRON VERTICAL MIXERS



For reasonably free-flowing materials, Sprout-Waldron verticals offer many advantages. They're compact—one with 1250 cu. ft. capacity occupies only 90 sq. ft. of floor space. They save power—a 1500 cu. ft. one operates on as little as 30 h.p. They're self-cleaning... dust-tight... pressure-tight... have facilities for drying, cooling, heating...and are available in many sizes in all types of materials.

SPROUT-WALDRON DISC BLENDERS



They go steps beyond mixing...they blend to the point where individual particles lose their identity. Materials are rubbed between opposing rotating discs, lumps are eliminated, thorough blends assured. You produce higher quality end products.

SPROUT-WALDRON MATERIALS HANDLING EQUIPMENT

To get materials to and from mixers, Sprout-Waldron offers complete lines of screw and belt conveyors, bucket elevators, feeders, and the revolutionary Pneu-Vac air handling system.

SW SPROUT·WALDRON

For Perfect Blends

OF DRY AND SEMI-DRY MATERIALS

SPROUT-WALDRON

Horizontal Batch Mixers

STYLE "B"

When your problem calls for the rapid, intimate mixing of small percentages of a number of critical ingredients with a large bulk of basic material or filler ...the answer is a Sprout-Waldron Style "B" Horizontal Batch Mixer.

It loads, blends, and discharges rapidly...is clean, dustless, sanitary. Effectively handles all types of dry, damp, and free-flowing wet materials. Available in a wide range of standard sizes—from 1 cu. ft. up to 1700 cu. ft.—to meet every capacity and power requirement. Built of any type of material required, and with discharge gates to suit all applications. Can be equipped with facilities for heating, drying, or cooling. Should you desire special variations, Sprout-Waldron "adaptioneering" methods can adapt the equipment to meet your needs.

WRITE FOR FULL DETAILS

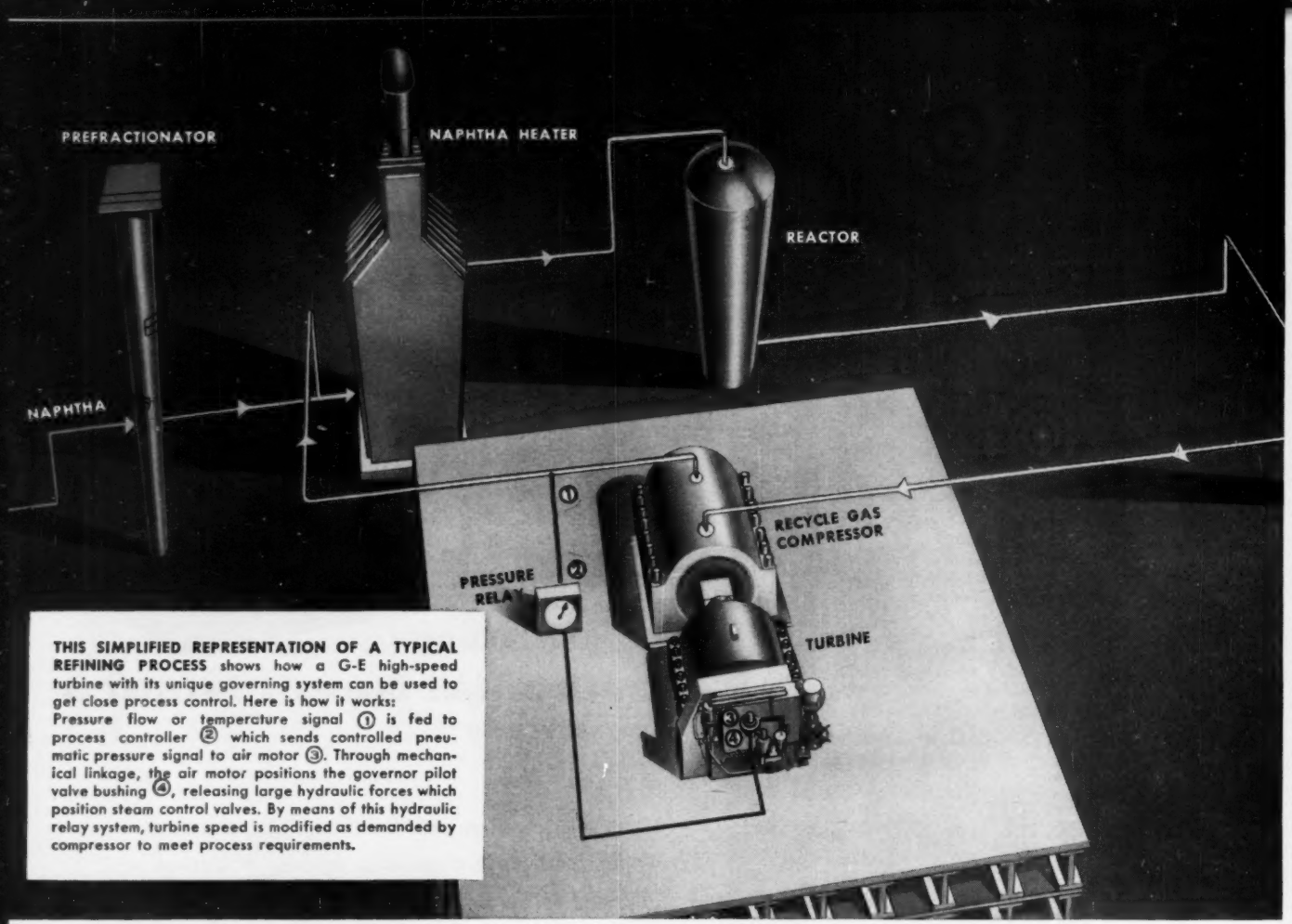
SPROUT-WALDRON

Manufacturing Engineers Since 1866

15 LOGAN STREET • MUNCY, PA.

Equipment for { SIZE REDUCTION, MIXING & BLENDING, PELLETING & CUBING, BULK MATERIALS HANDLING, PRODUCT CLASSIFICATION

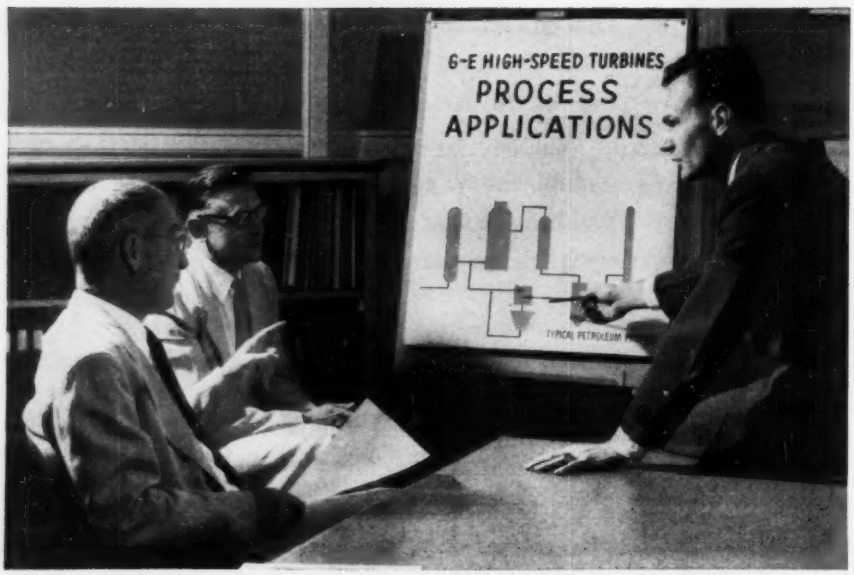
Facilities for fabricating, machining, custom founding, woodworking, laboratory testing



THIS SIMPLIFIED REPRESENTATION OF A TYPICAL REFINING PROCESS shows how a G-E high-speed turbine with its unique governing system can be used to get close process control. Here is how it works: Pressure flow or temperature signal ① is fed to process controller ② which sends controlled pneumatic pressure signal to air motor ③. Through mechanical linkage, the air motor positions the governor pilot valve bushing ④, releasing large hydraulic forces which position steam control valves. By means of this hydraulic relay system, turbine speed is modified as demanded by compressor to meet process requirements.

EASILY INCORPORATED INTO YOUR PRESENT SYSTEM . . .

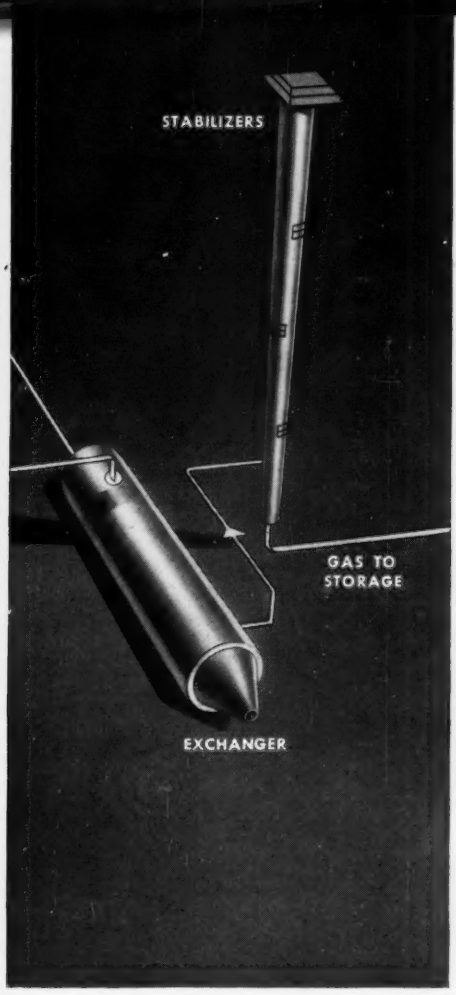
G-E position-restored turbine governing



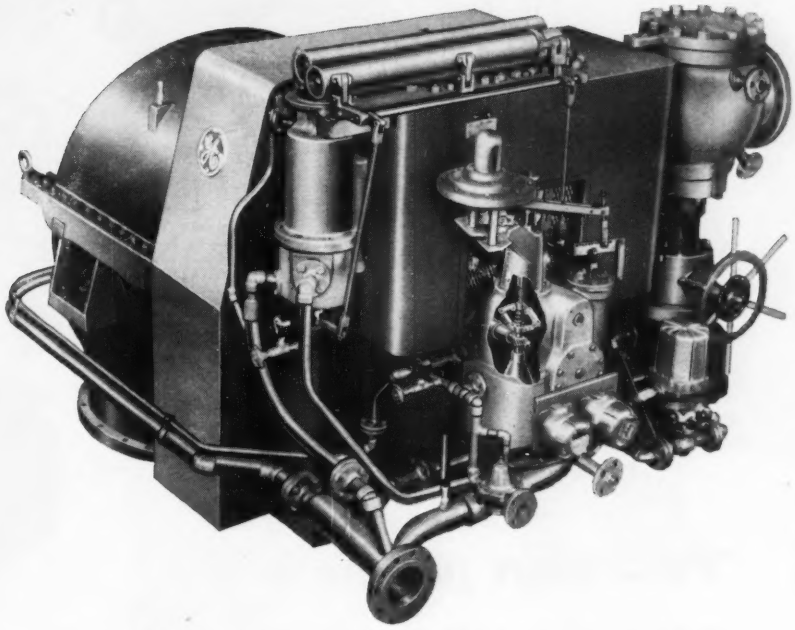
HERE IS THE SMALL TURBINE AND SUPERCHARGER DEPARTMENT MARKETING TEAM that can show you how to apply all the advantages of G-E high-speed turbine governing to your process operations. R. E. Donnelly, Manager—Marketing, discusses a possible petroleum application with H. J. Chase, Manager—Engineering, at left, and C. B. Seelig Manager—Sales, center.

HIGH-SPEED TURBINES FOR ALL PROCESS APPLICATIONS

- PETROLEUM
- CHEMICAL
- PETROCHEMICAL
- STEEL



TURBINES FOR HIGH-SPEED COMPRESSORS...



THE GENERAL ELECTRIC POSITION-RESTORED GOVERNOR, shown cutaway above, utilizes the best features of both mechanical and hydraulic control. Heart of the system is a fly-ball-positioned, rotating pilot valve, which releases a tremendous store of power to position the steam inlet valves. The released power is controlled through feedback by a weight-biased mechanical-linkage that repositions the pilot-valve bushing only in direct response to movement of the steam-inlet valves, rather than in response to a force generated by the movement of the valves.

can give you close process control

In process industries, if quality-control and peak production are to be maintained, turbines that drive high-speed compressors and blowers must have close, accurate governing in response to load requirement and the slightest variations in steam conditions.

To help you get more precise control, all G-E high-speed turbines have a position-restored governor. It is an oil-relayed, mechanical-type control device that automatically matches turbine speed to process demands.

This governor will operate accurately and effectively with any recycle controlling system because the mechanical-linkage can be adjusted to match the complete output-signal range of any process controller. The G-E governor can be incorporated with a typical control system as shown in the schematic drawing.

FOR CLOSE PROCESS CONTROL the unique design of the G-E high-speed turbine governor offers these advantages:

Accurate signal relay results since speed changes are made through a weight-biased mechanical-linkage which repositions the pilot valve bushing only in direct response to movement of the steam-inlet valve. The system is not affected by oil-flow forces and is quick to respond to changes in process requirements.

Direct, precise speed settings are therefore possible because turbine response to process requirements is not dependent on force balance between springs and signal pressure.

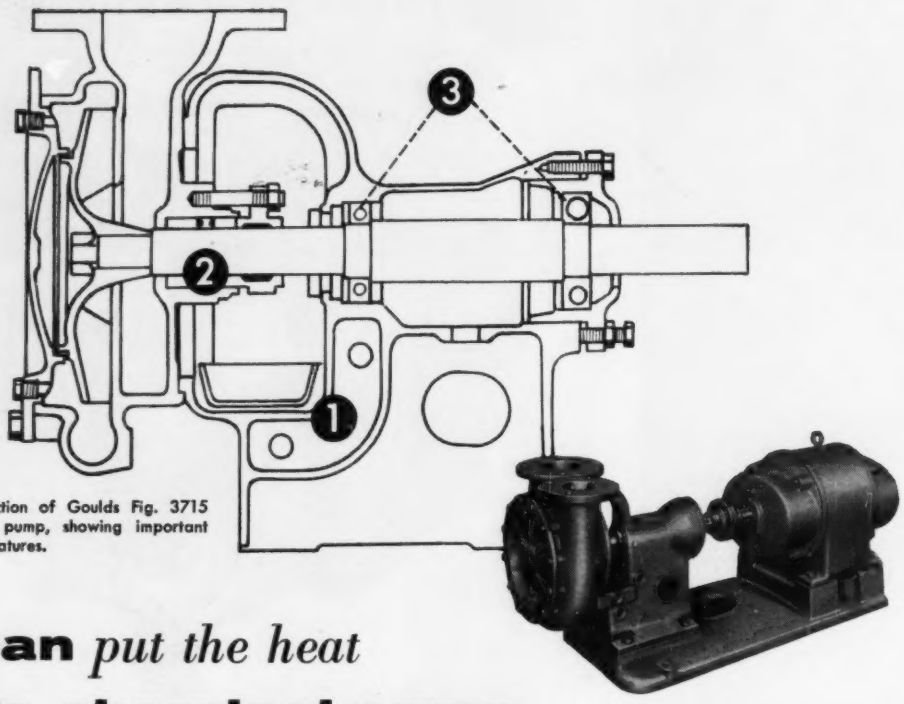
Completely integrated governing responds not only to process demand but also to steam pressure or temperature changes, which must be factored in for close process control.

Position-restored governing keeps the system in near-perfect equilibrium, practically eliminating speed surges and turbine "hunting." Be sure to see how this governing system may be used to advantage in your process operation.

For more detailed information, contact your nearest General Electric Apparatus Sales Office or write General Electric Company, Schenectady 5, N. Y. In Canada, contact Canadian General Electric Company, Limited, Toronto. 241-3

Progress Is Our Most Important Product

GENERAL ELECTRIC



Cross section of Goulds Fig. 3715 chemical pump, showing important design features.

You can *put the heat* on this chemical pump

Handling hot, corrosive, or abrasive liquids is what the Goulds Fig. 3715 pump is built for.

You can run this pump at 350° F. by cooling the support head (1) and quenching the gland, through fittings that are built in.

And you can get the pump in a variety of materials to meet your particular liquid-handling needs—type 316 stainless steel, Gould-A-Loy 20 (equivalent to ACI CN 7M CU), all bronze, bronze-fitted, all iron, or iron or bronze with stainless trim. These materials regularly stocked—other material can be furnished on order.

Wide range of sizes

There's a size, too, to meet most requirements—nine sizes in all, providing capacities up to 720 GPM, and heads to 200 ft.

Whatever size and construction material you need, you can be sure that your Goulds Fig. 3715 pump will operate with high efficiency and low maintenance cost.

Mechanical seals available

The stuffing box (2) is on the suction side of the impeller, subject to suction pressure only. Or we can equip your pump with either a single or double mechanical seal. Completely sealed bearings (3) keep out dirt and moisture, and are grease lubricated.

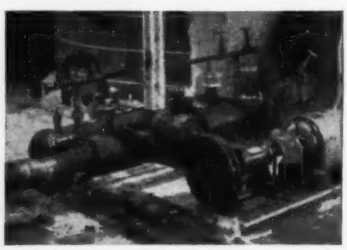
You can inspect and clean the interior of the pump, or remove and replace the impeller, without disturbing piping connections. You can adjust axial clearance between the impeller vanes and the casing by external means.

Interchangeability of parts

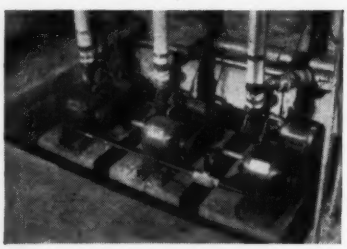
And you can keep your parts inventory low, for many of the parts are standardized for interchangeability between sizes. For example, you need only two different shafts for all 9 sizes of Fig. 3715 pumps.

We'd like to send you additional details about these chemical pumps. Just drop us a line, asking for Bulletin 725.4. It gives performance curves, sizes and specifications. Or, if you have a pumping problem of any kind one of our representatives will be glad to consult with you about it.

Goulds stainless steel pump handling corn meal mush in a food plant.



This Goulds chemical pump is handling hot fatty acids in an oil processing plant.



These three Goulds chemical pumps circulate hot size in a textile plant.

Goulds PUMPS INC. Seneca Falls New York

MEMBER HYDRAULIC INSTITUTE U.S.A.

ATLANTA • BOSTON • CHICAGO • HOUSTON • NEW YORK • PHILADELPHIA • PITTSBURGH • TULSA

"Brushing or Rolling...

Painting is Fun!"

IF YOUR ODORLESS PAINTS CONTAIN SINCLAIR ODORLESS SOLVENTS

SINCLAIR ODORLESS SOLVENT LIGHT

Distillation Range
IBP...345°F. EP...400°F.
Kauri-Butanol Value...27

SINCLAIR ODORLESS SOLVENT HEAVY

Distillation Range
IBP...375°F. EP...465°F.
Kauri-Butanol Value...26

By helping *you* create a truly odorless paint, Sinclair helps *you* keep *your* customers happy with *your* product. And that means more satisfied repeat customers, more volume through repeat sales for *your* business.

With either of Sinclair's two types of top-quality Odorless Solvents, you can produce a superior odorless paint. For your protection against contamination, Sinclair maintains a fleet of special tank cars, used *exclusively* in Odorless Solvent service. Light and Heavy Odorless Solvents are available in full and split tank car quantities. Prompt shipments to meet your production requirements are assured. For samples, prices and complete information on Sinclair Odorless Solvents, write or call –

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more performance . . .
FOR SUSTAINED HIGH OUTPUT!

more versatility . . .
FOR A WIDER RANGE OF WORK!

more dependability . . .
FOR LOWER JOB COSTS!

TWO NEW

HD-6

BULLDOZER-DRAWBAR TRACTOR

Weight	12,400
Drawbar hp	45
Belt hp	55

STEP UP PERFORMANCE, CUT MATERIAL HANDLING COSTS WITH EXCLUSIVE HD-6 FEATURES LIKE THESE . . .

★ Allis-Chalmers heavy-duty diesel engine — with "follow-through" combustion for long life, low upkeep.

★ 24-volt direct electric starting — for convenience and efficiency (standard equipment).

★ Wrap-around radiator guard for maximum strength and protection . . . tilts forward for easy service.

★ *Ceramic* master clutch lining — lengthens clutch life, reduces lever pull.

★ All-steel box-A main frame — protects the entire power train, makes possible superior balance . . . plus the service simplicity of unit construction.

★ One-piece steering clutch and final drive housing — for maximum strength, accurate bearing and gear alignment.

★ Double reduction final drives (straddle-mounted on tapered roller bearings) provide maximum ground clearance.

★ Roller bearing truck wheels — with Positive Seals that keep dust and moisture out . . . grease in.

★ 1,000-Hour lubrication intervals for truck wheels, idlers and support rollers.

★ Tru-Dimension tracks — with new standards of strength and hardness *throughout* for extra wearability.

★ Unit construction — major assemblies like engine, clutches and final drives can be removed without disturbing adjacent parts.

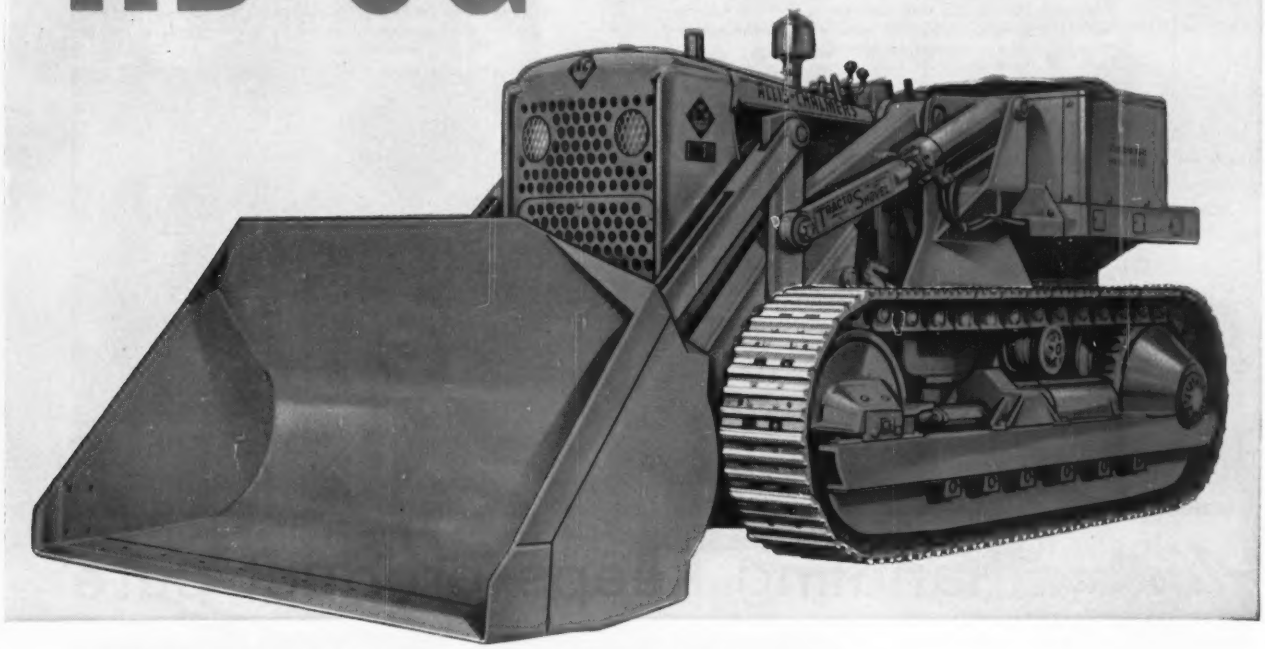
★ Engine-mounted bulldozers — for top performance and extra tractor life.

ALLIS-CHALMERS ANNOUNCES
HD-6 SERIES TRACTORS

HD-6G

TRACTOR SHOVEL

Weight	19,600
Drawbar hp	45
Net engine hp	57
Bucket capacity	1-1/3 cu yd



...PLUS TRACTOR SHOVEL FEATURES LIKE THESE...

- ★ Extra long track (almost 7 ft on the ground) with six truck wheels per side — for real stability throughout the digging and loading cycle.
- ★ New two-position bucket — for easy full-capacity loading in any material (standard equipment).
- ★ Heavy-duty shovel assembly — built right into the tractor, not just an attachment.
- ★ Simple, safe hydraulic system — with no exposed hoses or fittings on cowl or deck.
- ★ Two-speed reverse, high foam-rubber seat and easy bucket control — for new tractor-operator efficiency.

Big 2¼-cu yd bucket speeds handling of coal, snow, other light materials

GET ALL THE FACTS NOW FROM YOUR NEARBY ALLIS-CHALMERS DEALER

CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

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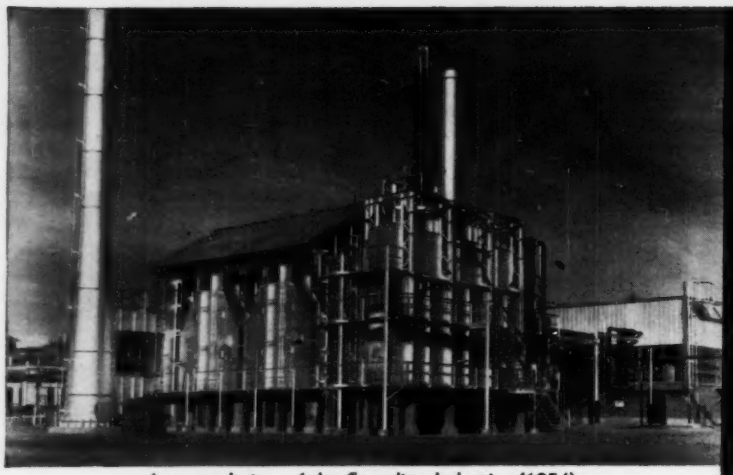
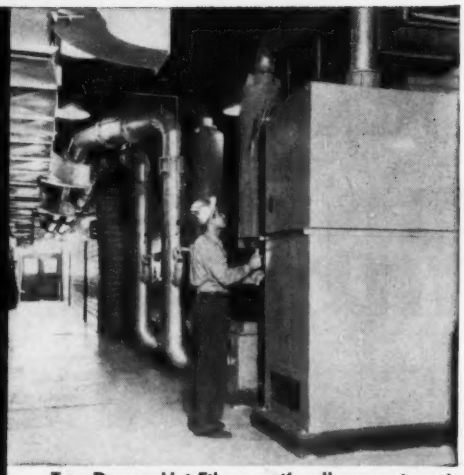


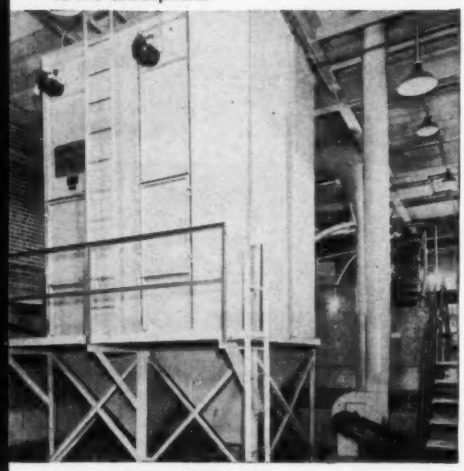
A general view of the Canadian Industries (1954), Ltd., plant in Edmonton, Alberta, where polythene resin is produced.



Two Dracco Uni-Filters purify all conveying air before use. Positive-displacement blowers provide the moving stream of conveying air.

Material introduced into conveying lines is blown 400 feet to storage. System requires minimum space —walls or floors present no obstacles.

Dracco Filter collects particles carried over from storage operation—only clean air is exhausted to the atmosphere.



Airstream handling keeps product pure

Problem—to convey cubes of chemically-pure polythene resin from process to storage without contamination at the Canadian Industries (1954), Ltd., plant in Edmonton, Alberta. Foreign matter, even in minute quantities, seriously affects the quality of this material.

Solution—a Dracco Airstream Conveyor which blows the material from end-of-process pick-up points to the storage warehouse, a distance of some 400 feet. Because the entire system is enclosed and conveying air is filtered before use, all contaminants are eliminated. There are no metal-to-metal moving parts coming into contact with the product.

Result—Airstream has afforded economical, contamination-free conveying. Operation of the entire system requires only the part-time attention of one man. The conveying air is also filtered after use, eliminating material waste and plant clean-up worries.

Airstream Conveyors are designed to handle any dry, bulk granular or powdered material economically, automatically and with a maximum of plant safety. To find out how Airstream can improve bulk materials handling in your plant, consult a Dracco engineer today!

DRACCO CORPORATION

4040 East 116th St. • Cleveland 5, Ohio

For further information on bulk materials handling with Dracco "Airstream" Conveyors, send today for Bulletin 529.

DRACCO *Performance Proved*

Airstream **CONVEYORS • DUST CONTROL EQUIPMENT**

Chemicals...

by the carload

In shipping your chemical production today you'll find new cleanliness, safety, convenience and economy in bulk consignments via North America's fleet of modern, specialized tank cars. You eliminate the superfluous handling, the cumbersome loading and unloading of old fashioned methods. You specify your requirements and we will meet them with your special linings that eliminate contamination, corrosive action, contact with metal. And your shipments go safe and sure to any destination on the continent where there's a railroad track. Call us. You'll get full co-operation.

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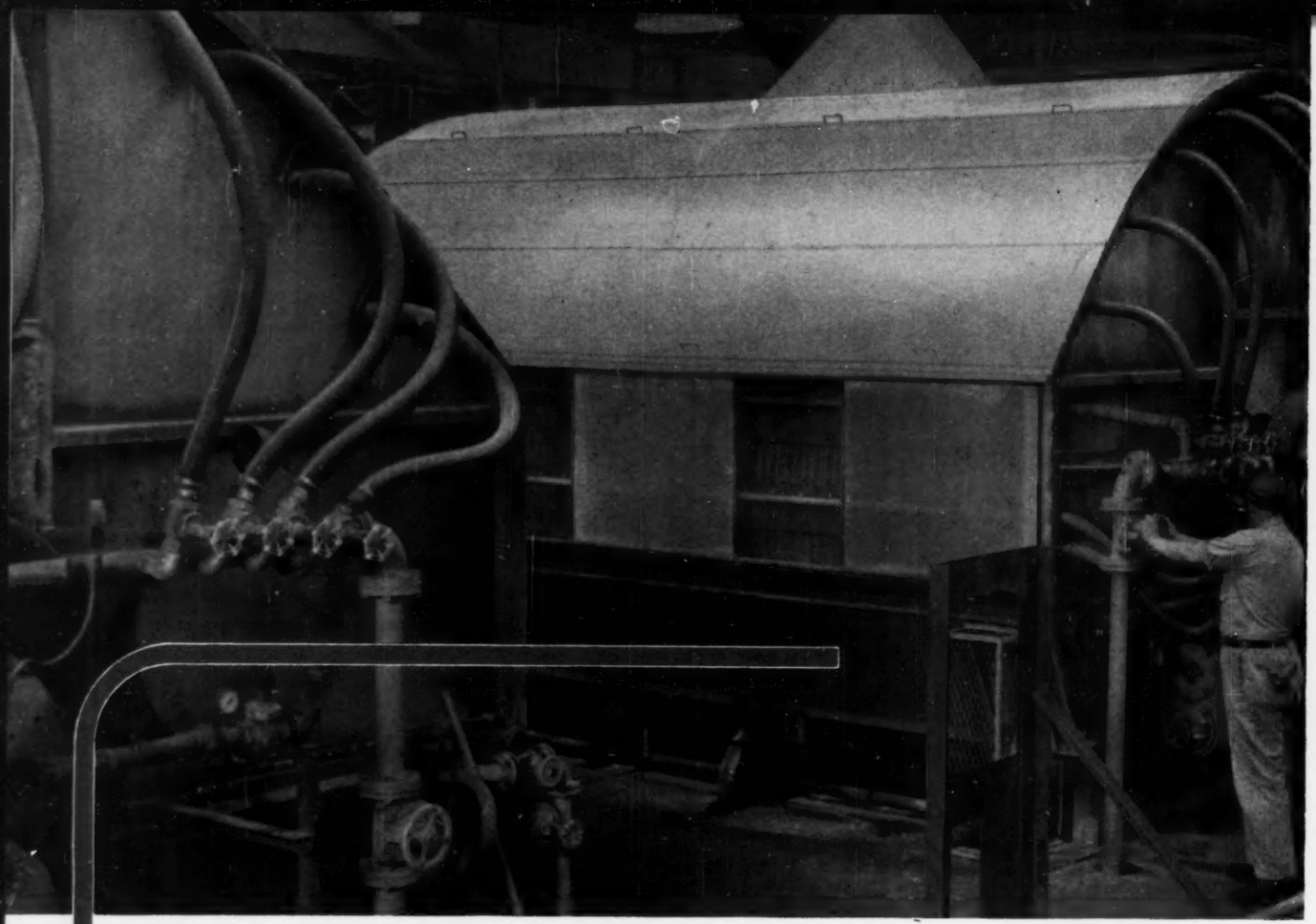
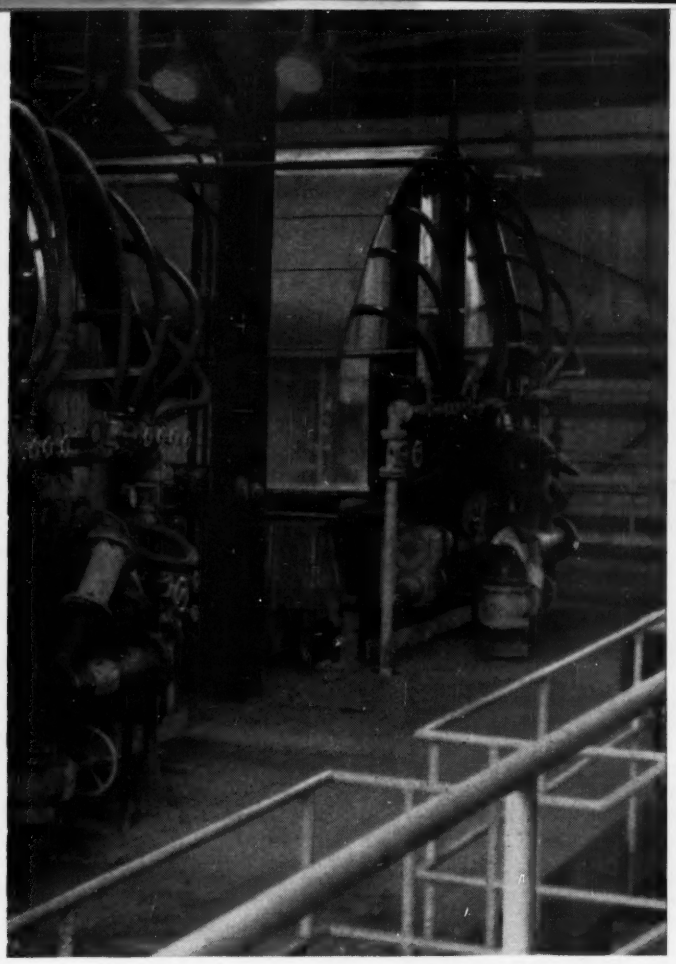


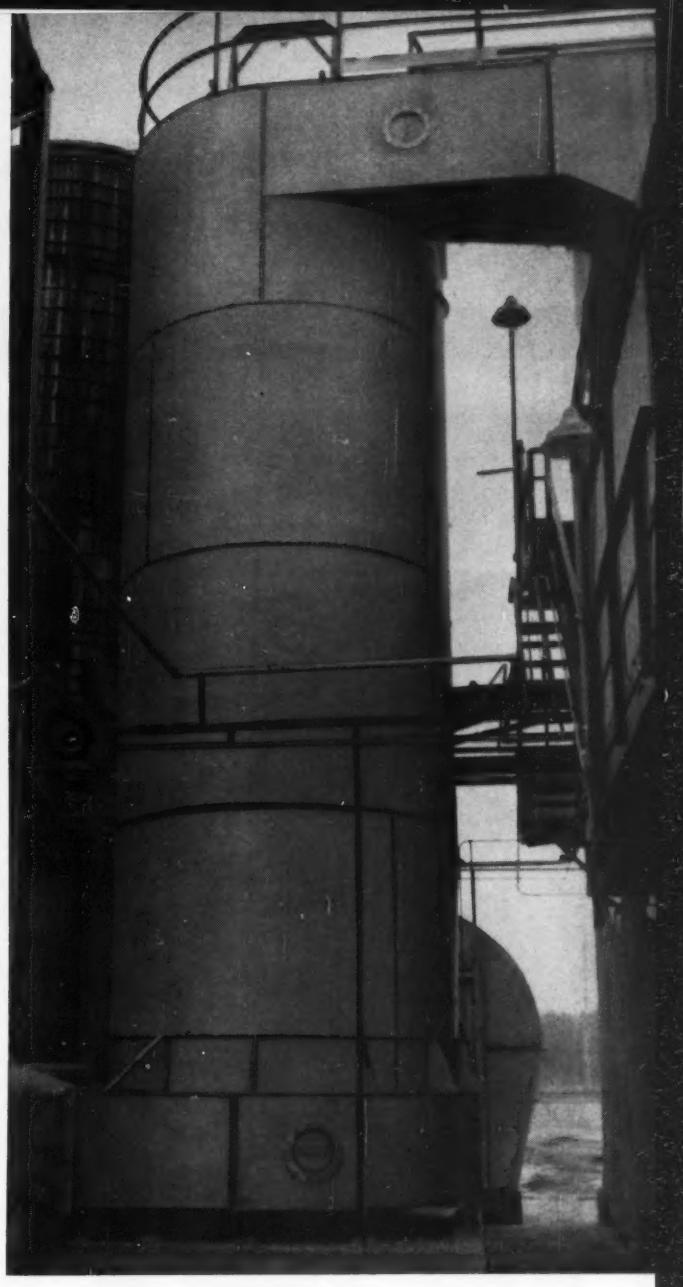
Here are three of the rotary vacuum filters. Hoods and flues are Type 304 Stainless Steel.

Stainless Steel hoods and scrubbers expected to last "indefinitely"

at AMERICAN CYANAMID COMPANY'S Michigan City, Indiana, plant

SEE THE UNITED STATES STEEL HOUR. *It's a full-hour TV program presented every other week* by United States Steel. Consult your local newspaper for time and station.





The scrubber. Made from Stainless Steel (including the draft fan), it is protected against internal or external corrosion.

THIS plant manufactures silica gel for use as a synthetic cracking catalyst in the petroleum industry.

The rotary vacuum filters are in use 'round the clock, 24 hours a day, 7 days a week. When the equipment was originally installed back in 1951, they decided to use Type 304 Stainless Steel for the hoods because of the highly acid and corrosive nature of the filtrate. The hoods are still in perfect condition; and the feeling is that they will last "indefinitely."

The same goes for the Type 304 Stainless Steel scrubber, used to scrub waste furnace gases before discharging to the atmosphere. The fan is also made from Stainless Steel. The scrubber is out in the open, exposed to the weather, and is in fine condition.

Stainless Steel in these two applications has eliminated the probability of periodic replacement of costly equipment. Further, it has eliminated the expense of annual painting.

When corrosion plagues you, an application of Stainless Steel will usually give you more return for your money than any other expenditure. And for service-tested quality, specify USS Stainless Steel.

UNITED STATES STEEL CORPORATION, PITTSBURGH · AMERICAN STEEL & WIRE DIVISION, CLEVELAND · COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
NATIONAL TUBE DIVISION, PITTSBURGH · TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. · UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
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USS STAINLESS STEEL

USS

SHEETS · STRIP · PLATES · BARS · BILLETS · PIPE · TUBES · WIRE · SPECIAL SECTIONS

UNITED STATES STEEL

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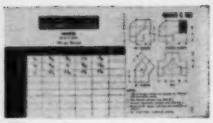

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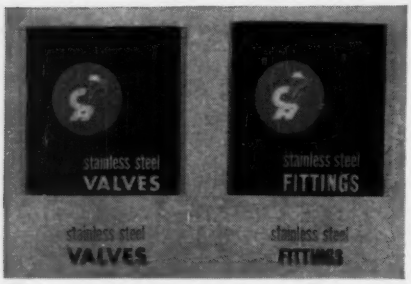

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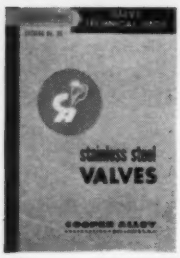

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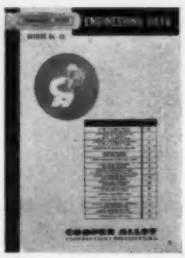

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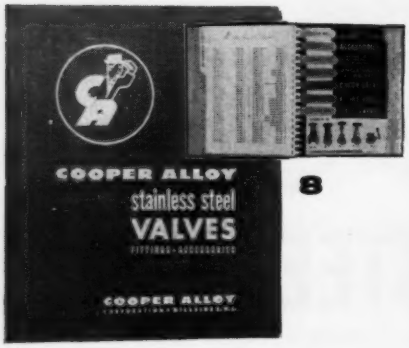

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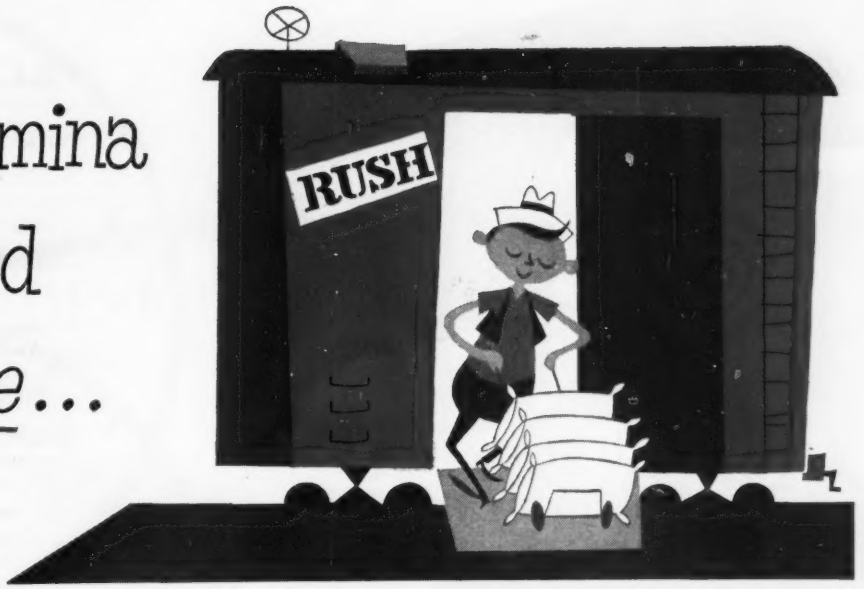

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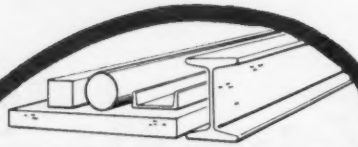

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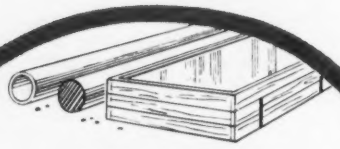

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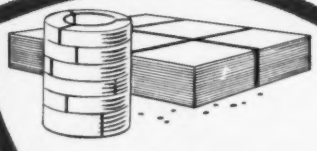

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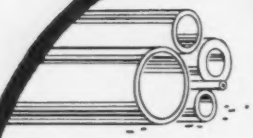

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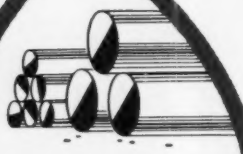

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Chemical Engineering NOVEMBER 1955

DRYING
DESIGN & COSTS

CHEMICAL ENGINEERING REPORT—NOVEMBER 1955

By WALTER C. LAPPLE, WILLIAM E. CLARK, Midwest Research Institute, and ERNEST C. DYBDAL, Monsanto Chemical Co.

In last month's report on drying (*Chem. Eng.*, Oct. 1955, pp. 191-210) we took note of underlying principles, classified dryers according to the characteristics of the material to be dried and the method of providing heat, and discussed all the main types of dryer suitable for process industry use. There the object was to assist the man with a drying problem to narrow the field of choice according to the technical aspects of various dryers.

In this second report our object is to narrow the choice still farther according to an economic analysis of the problem and of the various dryers which potentially might solve it. For that purpose we must first estimate the drying duty required in the particular problem and from that arrive at a preliminary estimate of heat requirements and of dryer cost, fob. and installed. Knowing these costs we can then make estimates of both the fixed charges and the operating costs for the applicable dryers, and thus weed out those which will be least economic.

Final selection, of course, must then be made on the basis of contacts with manufacturers of dryers, who can provide actual tests and firm figures on dryer and accessory costs.

Complete analysis of a specific drying problem ranges from conception of the need, to final selection of the dryer. It involves the following basic steps:

1. Establish a reason for drying.
2. Make a preliminary economic evaluation to justify further study of costs.
3. Make a preliminary selection of potentially suitable dryers.
4. Make a final dryer selection.

Reasons for Drying

There is scarcely a process industry which does not use some type of drying process, or have a potential need of drying to improve plant operation. Drying is often regarded as a finishing step in industrial processes, yet it is not uncommon to find it used also on raw materials or intermediates for technical or economic reasons.

There are many reasons why drying is employed in industrial operations:

1. To reduce freight charges for long-distance shipments.
2. To facilitate handling in subsequent process equipment such as conveyors, storage bins, etc.
3. To recover valuable solvent for reuse back in the process.
4. To achieve optimum capacity at other points in the process or reduce the consumption of fuel, reagents, power, etc., or other operating costs at these stages.
5. To assure the keeping quality of the product during shipment or storage.
6. To condition the material for such further treatments as screening, electrostatic separation, etc., which require dry material for maximum processing efficiency.
7. To increase the market appeal and saleable value of the product.

Once a good reason for drying has been established, the task of the engineer is twofold. He must select suitable drying equipment which will best integrate into the process as a whole. And he must evaluate the comparative advantages and disadvantages of various alternatives from the standpoint of technical and economic feasibility.

Before a final selection is made, it is almost always necessary to conduct pilot plant tests under conditions closely simulating those in an actual dryer of the type under consideration.

However, before a detailed study of the problem is made, the engineer is often asked to prepare a preliminary evaluation of the situation in the absence of extensive experimental drying data. This is done to provide information which will serve as a basis for managerial decisions on the desirability of further study of the drying problem.

If the material to be dried was formerly used in status quo, the economic justification for the proposed drying operation must first be determined. If drying constitutes

a proposed step in a new process under consideration, it is also of initial significance to prepare rough estimates of operating costs and capital outlay requirements. This is to establish the potential feasibility of manufacturing a competitively priced product.

When the replacement of old depreciated drying equipment in a going process for the use of supplementary drying equipment is being contemplated, the justification for drying is already proved. However, in such instances careful consideration should be given to recent developments in drying equipment to determine the possible advantages of new or improved drying techniques which could be incorporated in the new installation.

In any case, a drying problem should be studied with due recognition of the process conditions and limitations just proceeding and following the dryer. For example, the feed material may contain a substantial amount of free surface moisture which can be readily reduced by mechanical means such as filtration, compression rolls, centrifugation, etc. Dewatering of the feed in this manner should nearly always be considered first, for it is usually cheaper to effect moisture removal by mechanical systems than by thermal systems. Especially when large quantities of free liquid are associated with the material.

Sizing the Problem

In making a preliminary economic evaluation of a drying problem, the rapid estimation of installation and operating costs is the main concern. Preferably it would be desirable to establish such costs without undertaking a detailed performance analysis of specific dryers. The minimum amount of information which is needed for this purpose is as follows:

1. General facts for the purpose of weight and heat balance calculations
   a. Flow quantity of material to be handled in the dryer
   b. Initial and final moisture content of material
   c. Thermal and physical properties of solid, liquid, and gaseous phases
2. Evaporation requirements, lb. of moisture/hr.
3. Sensitivity of material to temperature
4. Sensitivity of material to combustion gases
5. Type of moisture associated with the material, i.e., surface, internal, or combined moisture
6. General characteristics of the material, such as:
   a. Particle size
   b. Corrosiveness
   c. Stickiness
   d. Abrasiveness
7. Available sources of heat, fuel and power

From the above information the answers to the following questions should be ascertained insofar as possible in a qualitative way:

1. Temperature limitations—What is the highest permissible temperature of the heating medium in keeping with limitations imposed by the material itself?
2. Material behavior limitations
   a. Is the material difficult to handle in a wet state?
   b. Will the state of subdivision of the material require that special allowance be made to prevent excessive dust losses?
   c. Will the drying rate be limited by internal diffusion of moisture?
3. Construction limitations
   a. Are special materials of construction required for surfaces in direct contact with the material being dried?
   b. Is indirect heating a requisite in order to prevent contamination from products of combustion?
   c. Are there any other extraordinary circumstances anticipated?

Answers to these generalized questions will be extremely helpful in estimating installed costs and power requirements as discussed later.

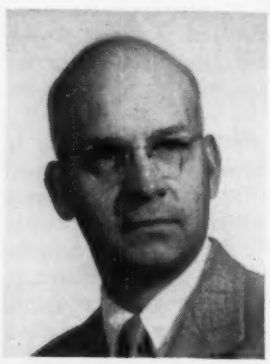
For example, if the material is difficult to handle in the wet state, it may be necessary either to recycle a part of the dry product for conditioning the feed or to employ special mechanical precautions in material handling. In cases where internal diffusion of moisture is the controlling factor in the drying process, larger dryers are normally required for a given evaporation capacity. If the material is dusty in nature, it may be necessary to employ high-efficiency cyclones to minimize product losses. All these factors related to material behavior tend to increase drying equipment costs.

Temperature Level and Heat Demand

Temperature is the greatest single factor influencing the unit capacity of the dryer. The temperature of the heating medium or the inlet temperature of the air admitted to convection dryers should always be as high as possible without deleterious effects on the material.

Lower temperatures may be employed, but it should be remembered that as a general rule the sensible heat losses in the exhaust gases are thus greatly increased. This is a result of the higher air flow which is consequently required in order to provide the necessary heat for evaporation. Fuel and power requirements would therefore be substantially increased, and the amount of dust elutriated from a given dryer would be greater.

ERNEST C. DYBDAL this month joins Walt Lapple and Bill Clark whom you met last month (*Chem. Eng.*, Oct. 1955, p. 192). Dybdal has contributed extensive data on costs and performances of dryers which Lapple and Clark integrated with their own material in preparing Part II of this report. Senior chemical engineer with Monsanto's research and engineering division in Dayton, Ohio, Dybdal has 22 years of industrial experience, first with Thomas and Hochwalt Laboratories, Inc., and then with Monsanto when that company acquired the laboratories. He has a BS from Antioch College, and has authored several other articles, including one on process evaluation.



Equations for Calculating Required Exposed Drying Surfaces in Convection Drying — Table I

	Above Critical Moisture Content	Below Critical Moisture Content
1. Constant batch drying conditions	$A_s = \dfrac{\lambda_s(W_1 - W_2)}{\theta_c h_c (t_a - t_s)}$	$A_f = \dfrac{\lambda_s F_c W_d}{\theta_f h_c (t_a - t_s)} \ln \dfrac{F_1}{F_2}$
2. Variable drying conditions		
a. Adiabatic counter-flow dryer ($R = 1$)	$A_s = GR\left(\dfrac{c_s}{h_c}\right) \ln \dfrac{1 - \dfrac{D}{G}\left(\dfrac{F_c - F_2}{t_1 - t_s}\right)\left(\dfrac{1}{R}\right)\left(\dfrac{\lambda_s}{c_s}\right)}{1 - \dfrac{D}{G}\left(\dfrac{F_1 - F_2}{t_1 - t_s}\right)\left(\dfrac{1}{R}\right)\left(\dfrac{\lambda_s}{c_s}\right)}$	$A_f = GR\left(\dfrac{c_s}{h_c}\right)\left[\dfrac{1}{\dfrac{F_2}{F_c} + \dfrac{G}{D}\left(\dfrac{t_1 - t_s}{F_c}\right)\left(\dfrac{Rc_s}{\lambda_s}\right)}\right] \ln\left(\dfrac{F_c}{F_2}\right)\left[\dfrac{1}{1 - \dfrac{D}{G}\left(\dfrac{F_c - F_2}{t_1 - t_s}\right)\left(\dfrac{1}{R}\right)\left(\dfrac{\lambda_s}{c_s}\right)}\right]$
b. Adiabatic parallel-flow dryer ($R = 1$)	$A_s = GR\left(\dfrac{c_s}{h_c}\right) \ln \dfrac{1}{1 - \dfrac{D}{G}\left(\dfrac{F_1 - F_c}{t_1 - t_s}\right)\left(\dfrac{1}{R}\right)\left(\dfrac{\lambda_s}{c_s}\right)}$	$A_f = GR\left(\dfrac{c_s}{h_c}\right)\left[\dfrac{1}{\dfrac{F_1}{F_c} - \dfrac{G}{D}\left(\dfrac{t_1 - t_s}{F_c}\right)\left(\dfrac{Rc_s}{\lambda_s}\right)}\right] \ln\left(\dfrac{F_2}{F_c}\right)\left[\dfrac{1 - \dfrac{D}{G}\left(\dfrac{F_1 - F_c}{t_1 - t_s}\right)\left(\dfrac{1}{R}\right)\left(\dfrac{\lambda_s}{c_s}\right)}{1 - \dfrac{D}{G}\left(\dfrac{F_1 - F_2}{t_1 - t_s}\right)\left(\dfrac{1}{R}\right)\left(\dfrac{\lambda_s}{c_s}\right)}\right]$
c. Adiabatic intermittent dryer ($R = 1$ and complete mixing of charge assumed)	$A_s = GR\left(\dfrac{c_s}{h_c}\right) \ln \dfrac{1}{1 - \dfrac{W_1 - W_2}{G\theta_c}\left(\dfrac{1}{t_1 - t_s}\right)\left(\dfrac{1}{R}\right)\left(\dfrac{\lambda_s}{c_s}\right)}$	Solution involves the use of partial differential equations.
d. Non-adiabatic counter-flow dryer ($R = 1$) and/or slopes of operating and constant wet bulb temperature lines not equal)	$A_s = \dfrac{G\lambda_s}{h_c} \int_{H_1+y}^{H_1+x} \left(\dfrac{1}{t_a - t_s}\right) dH_a$	$A_f = \dfrac{F_c G \lambda_s}{h_c} \int_{H_1}^{H_1+y} \dfrac{1}{\left[F_2 + \dfrac{G}{D}(H_a - H_1)\right](t_a - t_s)} dH_a$
	where $x = (D/G)(F_1 - F_2)$,	$y = (D/G)(F_c - F_2)$
e. Non-adiabatic parallel-flow dryer ($R = 1$ and/or slopes of operating and constant wet bulb temperature lines not equal)	$A_s = \dfrac{G\lambda_s}{h_c} \int_{H_1}^{H_1+x} \left(\dfrac{1}{t_a - t_s}\right) dH_a$	$A_f = \dfrac{F_c G \lambda_s}{h_c} \int_{H_1+x}^{H_1+z} \dfrac{1}{\left[F_1 - \dfrac{G}{D}(H_a - H_1)\right](t_a - t_s)} dH_a$
	where $x = (D/G)(F_1 - F_2)$,	$z = (D/G)(F_1 - F_c)$

Note: If the drying is limited to operation either above or below the critical moisture content, all values of F_c following the integal or log signs become equal to F_2 or F_1, respectively.

For nomenclature see p. 183.

On the other hand, it is frequently possible to reduce the heat losses to the stack by recycling part of the exhaust gases. This practice is also a means of controlling humidity which may be desirable for attaining a maximum safe drying capacity.

When no temperature requirements are imposed by the material to be dried, higher temperatures may be used if they can be tolerated by the materials of construction. Ordinary steel, for example, loses its strength rapidly at temperatures above 650°F. but may be used up to about 1,000°F. provided that it is not subjected to undue mechanical stress or a corrosive atmosphere.

Fuel consumption in a drying operation is normally the most significant operating cost element. The heat requirements for a drying operation can easily (and best) be estimated on the basis of an over-all heat balance cal-

Critical Moisture Contents of Materials—Table II

Organic Materials		Inorganic Materials		Range of Critical Moisture Content
Characteristics	Examples	Characteristics	Examples	%Water, Dry Basis
		Coarse, nonporous materials larger than 50 mesh	Quartz	3–5
Very coarse fiber	Wool serge, undyed	Crystalline, granular, relatively nonporous materials, intermediate particle size, 50–325 mesh	Salt, sea sand, mineral ores	5–15
Crystalline, granular, low porosity materials	Glutamic acid hydrochloride (in HCl soln.)	Fine crystalline, porous materials	Niter cake fines, very fine sand, clay mixtures, subsoil	15–25
Coarse fiber, fine powders	Worsted wool, cellulose acetate, book paper, carbon pigment	Fine precipitates, amorphous and colloidal materials, pigments	Calcium carbonate, fine clays, Prussian blue	25–50
Fine fiber, amorphous and homogeneous compressed materials	Starch, sulfite pulp, sole leather	Extruded pastes, inorganic salts of organic compounds	Calcium and magnesium carbonates, titanium dioxide, calcium stearate	50–100
Discontinuous compressed, colloidal, and gelatinous materials	Chrome leather, wallboard, gelatin	Inorganic salts of organic compounds, mordants, adsorbents	Zinc stearate, stannic tetrachloride, silica gel, alumina hydrate	100–300

culation. The heat supplied to a drying operation is utilized in providing the latent heat of evaporation, the heat losses by radiation to the surroundings, and the sensible heat necessary to raise the temperature of each system component to its exit temperature. For example, in the case of a dryer employing convected heat, it follows approximately that for an air-water-solid system

$$Q = G(0.24 + 0.45H_1)(t_2 - t_o) + (1 + r)[0.45D(M_1 - M_2) \times (t_2 - t_f) + D(M_1 - M_2)\lambda_f + D(C_p + M_2)(t_p - t_f)] \quad (1)$$

or

$$Q = q + G(0.24 + 0.45H_1)(t_1 - t_o) \quad (2)$$

From an over-all moisture balance,

$$G = \frac{D(M_1 - M_2)}{H_2 - H_1} = \frac{w}{H_2 - H_1} \quad (3)$$

Eqs. (1) and (2) may thus be rewritten respectively as follows:

$$Q = (w)(1 + r)[\lambda_f + 0.45(t_2 - t_f) + (C_p + M_2) \times \left(\frac{t_p - t_f}{M_1 - M_2}\right) + \left(\frac{0.24 + 0.45H_1}{1 + R}\right)\left(\frac{t_1 - t_o}{H_1 - H_1}\right)] \quad (4)$$

$$q = Q - w(0.24 + 0.45H_1)\left(\frac{t_1 - t_o}{H_1 - H_1}\right) \quad (5)$$

where

- C_p Specific heat of dry stock, Btu./(lb.)(F.)
- D Feed rate of dry stock to a dryer, lb./hr.
- G Flow rate of drying air stream, lb. dry air/hr.
- H_1, H_2 Humidity of drying air stream entering and leaving a dryer, respectively, lb. water/lb. dry air.
- M_1, M_2 Total moisture content of feed material and dried product, respectively, lb./lb. dry stock.
- q Additional heat added within the dryer by steam tubes or other means, Btu./hr.
- Q Total heat requirement for dryer, Btu./hr.
- r Radiation losses expressed as a fraction of the net heat transferred to the material being dried.
- t_o Temperature of air entering heater, F.
- t_1, t_2 Dry bulb temperature of air entering and leaving dryer, respectively, F.
- t_f Temperature of feed, F.
- t_p Temperature of dried product, F.
- w Evaporation capacity, lb. of moisture/hr.
- λ_f Latent heat of evaporation at t_f, Btu./lb.

In any specific operation, fuel consumption is dependent on the method of dryer operation and the manner in which heat is applied to the system. The method of dryer operation is often dependent on the temperature limitations imposed by the material being dried.

Either constant temperature or concurrent adiabatic operation is practiced when the material is subject to heat damage after it is dried or even partially dried. Materials that may be injured by heat in the wet state are best dried in adiabatic countercurrent dryers because of the close regulation of product temperature automatically maintained under constant wet bulb conditions. Once terminal dryer conditions have thus been selected by reference to a humidity chart as previously discussed (Oct. 1955, p. 193), fuel requirements can be closely and directly estimated by making the proper substitutions in Eqs. (4) and (5), provided that heat is supplied by means of combustion gases. If an indirect air heater is employed, the fuel consumption may be greater by 50 to 100% or more due to increased heat losses. Values of r, the radiation losses, may be as low as 3% and as high as 10% or more depending on the type of dryer and its insulation.

Sizing the Dryer

For preliminary estimation of dryer size Table I lists a number of theoretical equations by which, for various methods of drying, it is possible to calculate the approximate heat transfer or drying surface between material and drying medium that is needed to accomplish drying under the specified conditions of (1) material dried per unit time; (2) moisture removal per unit time; (3) air flow

rate; (4) initial air condition and temperature; and (5) final air condition and temperature. (The method of deriving these equations is shown in the Derivation section, pp. 182-5.) Then, having the estimate of drying surface, it is possible to estimate the sizes of various types of dryer, and hence the dryer cost.

Although dryers are generally not designed wholly on the basis of theoretical considerations, theory is a useful tool for many reasons:

1. To determine the effects of different methods of dryer operation and establish the optimum practice for achieving the desired results in the dryer under study.
2. To estimate the effects of changing operating conditions on the capacity of existing dryers.
3. To correlate results from pilot plant drying studies by comparing theoretical requirements for exposed drying area or retention time with observed values.
4. To serve as a means of evaluating relative equipment sizes and costs when preparing high-spot comparisons of potentially suitable dryers as a preliminary to the final selection of a dryer for a given service.
5. To serve as an approximate basis for the development and design of a new type of dryer when existing models are unadaptable.

Before going ahead with the preliminary calculations on dryer sizing, it is always helpful to dry a sample of the material in laboratory equipment to determine its handling characteristics, rough drying rates at various thicknesses, and approximate range of critical moisture contents. Such a test will not be very accurate unless it closely simulates conditions in the full-scale dryer, but the information it will afford will be better than an outright guess.

Using the Theory

In order to employ the theoretical equations in Table I, it is required that the following basic information be established: (1) Terminal conditions of the dryer; (2) local or over-all heat transfer coefficients; and (3) critical moisture content of material being dried.

The terminal conditions of the dryer are selected to comply with the temperature limitations of the material being dried and the relative humidity which can be tolerated in the exhaust gases.

The heat transfer coefficient varies with dryer design, the manner by which heat is therein transferred and/or the directional flow rate of the heating medium. Eqs. (21), (22), and (23) in the Derivation section apply where air flows over and through the drying solids.

In the case of indirect drying, values of over-all heat transfer coefficients for use in the general heat transfer equation $Q = UA\Delta T$ are not as easily predictable but some generalizations can be made for ordinary temperature conditions. The coefficient may be on the order of 1 to 5 Btu./(hr.)(sq.ft.)(F.) if the material is not agitated or if the walls of agitated dryers become caked. For indirect rotary dryers and other drying equipment provided with moderate agitation (2-25 rpm. in the case of screw conveyor dryers), the heat transfer coefficient will range from about 5 to 15 if the dryer walls are maintained reasonably clean. Values from 15 to 25 may be realized at higher degrees of agitation (25-200 rpm. in the case of screw conveyor dryers), and values up to 50 might be achieved if positive scraping action is provided.

At temperatures higher than ordinary steam temperature, the coefficient in general may be substantially improved as a result of increased heat transfer by radiation.

The critical moisture content is essentially a function of many physical and chemical characteristics of the material itself and can not be determined quantitatively without resorting to actual drying tests. However, for the purpose of making very preliminary design calculations, an attempt has been made to formulate a system of classifying critical moisture contents on the basis of the general characteristics of the material being dried—Table II.

It should be remembered that the critical moisture content of a given material is not necessarily a constant but may also vary with the drying rate and the thickness of the material. The greater the drying rate and the thicker the layer of the material being dried, the greater is the moisture gradient within the material. Critical moisture conditions may thus be reached on the surface at higher average moisture contents of the material.

In obtaining the theoretical relationships in the Derivation section, it was assumed that the temperature of the stock was held within narrow or known psychrometric limits in the absence of radiation losses. In practice, the stock must first be heated up to evaporation temperature before drying takes place at an appreciable rate. Drying will then commence with a slight temperature rise until a low moisture content is achieved. Before this point is attained, drying is generally discontinued unless an exceptionally dry product is desired. In the latter case, the temperature of the material is permitted to rise to the desired level.

For the sake of simplicity in the preliminary calculation of area requirements for exposed drying surface, the following procedure is thus suggested in the cast of convection drying on a continuous basis.

1. Select the terminal conditions of the dryer on the humidity chart.
2. Assume the absence of preheating, radiation, and superheating effects.
3. Calculate the value of air flow rate, G, from Eq. (3).
4. Calculate the appropriate value of the heat transfer coefficient (Eqs. (21), (22) or (23) in Derivation section).
5. Estimate the critical moisture content from Table II or preferably on the basis of an actual drying test if possible.
6. By means of appropriate equations presented in Table I, calculate the required drying surfaces where $A_t = A_c + A_f$. These equations apply for through-circulation drying as well as for cross-circulation for drying.

The first equation is limited to drying under constant conditions: constant stock temperature, air temperature, humidity, velocity and direction. Some of these conditions may well vary, however, in normal drying practice. For instance, air temperature and humidity will change, especially in continuous operation. Hence, Eqs. (2a) to (2e) are the most generally useful.

Eq. (2c), for adiabatic intermittent drying, applies to most commercial batch drying by convection.

7. Correct for preheating, radiation, and superheating effects by multiplying the area A_t calculated in the previous step by the following factor J, which is a semi-quantitative but reasonable expression deduced from Eq. (1):

$$J = (1 + r)\left[\frac{\lambda_f}{\lambda_p} + \frac{(C_p + F_2)(t_p - t_f)}{\lambda_p(F_1 - F_2)}\right] \quad (6)$$

where λ_p = Latent heat evaporation at t_p, Btu./lb.

Specific dryer design requires that a proper selection of gas velocity be made and that the solids hold-up capacity or retention time requirements be estimated. For cross-circulation dryers, normal velocities are from 4 to 6 ft./sec. If the dusting tendency of the material is great, the superficial velocity, particularly at the point of discharge, is maintained at a substantially lower level of 1-2 ft./sec.

In the case of pneumatic conveyor dryers, gas velocities equal to about twice the free-settling velocity of the largest size particle are generally employed. Actual velocities may range from 50 to 200 ft./sec., but for rough estimating purposes a value of about 75 ft./sec. seems to represent a reasonable average. Solid-to-gas loadings are normally of the order of 0.5 to 1.0 lb. solid/lb. gas although values up to 2.0 or more might be tolerated depending on how well the system is designed and on the nature of the material being handled.

In the case of fluid-bed dryers, the minimum velocity required for good fluidization may be closely predicted by the empirical relationship:

$$V_o = 0.1V_p \quad (7)$$

where V_o = superficial gas velocity, ft./sec., and V_p = free-settling velocity of the average size particle, ft./sec.

If S is equal to the surface available for drying expressed in sq. ft./cu. ft. of dry stock volume, it follows that

$$\text{Volumetric hold-up} = A_t/S \text{ cu. ft.} \quad (8)$$

or

$$\text{Weight hold-up} = \rho_b A_t/S \text{ lb. of dry stock} \quad (9)$$

where ρ_b = bulk density of the dry granular bed, lb./cu. ft. It should be noted that the above calculations of weight holdup are necessary only for continuous operation since in batch operation the size of the batch is synonymous with weight holdup.

In continuous cross-circulation drying the determination of S, the surface area presented by each cubic foot of solid being dried, requires that a selection of a value for bed thickness be made in keeping with the critical moisture content used in the drying calculations.

In suspended solids drying and through-circulation drying, thickness of the bed has little signficance except as it affects pressure drop and power costs. But in cross-circulation drying, thickness of the bed of material being dried may be all important to the rate of drying. It may affect the critical moisture content—and the extent of drying possible at a constant rate. It may also alter the rate of drying in the falling rate zone.

Once factors affecting the drying rate are established, bed thickness is implicit in the conditions prescribed by the engineer for batch drying: so much water to be evaporated in a certain amount of time from a certain amount of material (which must present a certain area to the drying medium). However, in continuous drying the thickness

Drying Equation

Constant-Rate Period

Heat and mass transfer balances constitute the basis for drying calculations. It is the relatively thin and stagnant film of air separating a stationary surface from the adjacent current of air that restricts the vaporization of moisture into the air stream or the transfer of heat from the air streams to the drying surface. These transfer operations can be expressed in the form of a rate equation:

Rate = Driving force / Resistance

In the case of heat transfer the driving force is the temperature drop across the air film, whereas for mass transfer it is the vapor pressure gradient. The higher the inequality of temperature or vapor pressure, the greater the rate of drying. This rate of drying is, of course, also directly proportional to the area of exposed drying surface. Thus, when dealing with through-circulation drying systems, it is obvious that the drying rate for a given weight of solid varies inversely as some function of particle size.

With reference to the constant-rate period of drying, the above statements may now be formulated into quantitative expressions as follows: For mass transfer,

$$-\frac{dW}{A_c\,d\theta_c} = \frac{w}{A_c} = \frac{\Delta P}{1/k_g} = \frac{P_s - P_a}{1/k_g} \quad (1)$$

Or

$$w = k_g A_c(P_s - P_a) \quad (2)$$

For convenience in drying calculations, the driving force in the rate equation is usually expressed as the humidity difference, $H_s - H_a$. At ordinary temperature conditions, the partial pressure of water vapor is small in comparison with the total pressure and it thus becomes possible to transform equation (2) into the desired approximate form as shown below:

By definition,

$$H = 18P/[29(1 - P)] \quad (3)$$

or approximately,

$$H = (18/29)P \quad (4)$$

Therefore,

$$w = (29/18)k_g A_c(H_s - H_a) \quad (5)$$

or

$$w = k_g' A_c(H_s - H_a) \quad (6)$$

and

$$A_c = \frac{W_1 - W_2}{k_g'\theta_c(H_s - H_a)} \quad (7)$$

For heat transfer,

(a) Convection

$$\frac{q}{A} = \frac{\Delta t}{1/h_c} = \frac{t_a - t_s}{1/h_c} \quad (8)$$

$$q = h_c A(t_a - t_s) \quad (9)$$

(b) Conduction

$$\frac{q}{A} = \frac{\Delta t}{x/k} = \frac{t_h - t_s}{x/k} \quad (10)$$

$$q = (k/x)A(t_h - t_s) \quad (11)$$

(c) Radiation

$$\frac{q}{A} = \frac{t_r - t_s}{1/\epsilon h_r} \quad (12)$$

$$q = \epsilon h_r A(t_r - t_s) \quad (13)$$

where

$$h_r = \frac{0.173[(t_r/100)^4 - (t_s/100)^4]}{t_r - t_s} \quad (14)$$

Derivations

The latent heat of the diffusing vapor stream is $\lambda_s w$, which can be approximately equated to the sensible heat transferred to the surface as shown below:

$$\lambda_s w = \lambda_s k_g' A_c (H_s - H_a) = h_c A_c (t_a - t_s) + \epsilon h_r A_c (t_r - t_s) + (k/x) A_c (t_k - t_s) \quad (15)$$

Or

$$(1/R)(\lambda_s/c_s)(H_s - H_a) = (t_a - t_s) + \epsilon (h_r/h_c)(t_r - t_s) + (k/x h_c)(t_k - t_s) \quad (16)$$

where

$$R = h_c/k_g' c_s \quad (17)$$

For air-water vapor mixtures it has been empirically determined that the psychrometric ratio, R, is substantially equal to unity. In this case, the ratio, h_c/k_g', is thus equal to c_s, where $c_s = 0.238 + 0.45\ H_s$, and an average value for this ratio is about 0.26. For this system in the absence of radiation and conduction effects, equation (16) may then be rewritten as follows:

$$\lambda_s (H_s - H_a) = c_s (t_a - t_s) = (h_c/k_g')(t_a - t_s) \quad (18)$$

and A_c can be expressed as

$$\frac{\lambda_s (W_1 - W_2)}{\theta_c h_c (t_a - t_s)} \quad (18a)$$

since, at equilibrium, $\lambda K_g' (H_s - H_a) = h_c (t_a - t_s)$. Eq. 18 demonstrates the reason why the adiabatic cooling lines and the constant wet-bulb temperature lines on the humidity chart for air-water vapor mixtures coincide for all practical purposes. Once an appropriate value for h_c is established, Eq. (16) or (18) can then be employed to approximate H_s and the surface temperature, t_s, by a series of trial and error calculations or by graphical methods in conjunction with the use of a humidity chart.

If no experimental data on the psychrometric ratio for a given system are available, the value of R can be estimated from the following relationships:

$$R = \frac{h_c}{k_g' c_s} = \frac{(1/D_g M_A) + 21}{(c_s/k_m) + 21} \quad (19)$$

$$D_g = 0.00943 \frac{(460 + t_s)^{1/2}}{(V_A^{1/3} + V_B^{1/3})^2} \sqrt{\frac{1}{M_A} + \frac{1}{M_B}} \quad (20)$$

For many organic liquids the value of R may range from 1.5 to 2.0.

Analogy Between Heat and Mass Transfer

There is a direct analogy between the film coefficient of heat transfer and the film coefficient for diffusion. Both are a measure of the degree to which a particular transfer operation is inhibited. Both vary inversely with the thickness of the air film. The thickness of the film of air and consequently the drying rate are dependent on the direction and the velocity of the air stream over the surface.

For air flow parallel to the plane surface it has been found that

$$h_c = 0.0128 (V\rho)^{0.8} \quad (21)$$

For air flow normal to the drying surface,

$$h_c = 0.37 (V\rho)^{0.37} \quad (22)$$

In the case of through-circulation air drying

$$\left(Re = \frac{D_p V \rho}{\mu} > 350\right)$$

$$h_c = [0.37 c_s (V\rho)^{0.59} (1 - \epsilon)]/D_p^{0.41} \quad (23)$$

For air flow parallel to a surface, it will be noted from equa-

Nomenclature

A	Drying area, sq. ft.
A_c	Area of stock exposed in constant-rate period, sq. ft.
A_f	Area of stock exposed to drying in falling-rate period, sq. ft.
c_s	Humid heat, Btu./(lb. dry gas)(F.)
D	Feed rate of dry stock to dryer, lb./hr.
D_g	Gas diffusivity, lb.-moles/(hr.)(ft.)
D_p	Average particle diameter, ft.
e	Porosity, volume of void space/total volume of dry stock
F	$M - M_e$, free moisture content, lb./lb. dry stock
F_c	Free moisture content at critical point, lb./lb. dry stock
F_1	Free moisture content of feed material, lb./lb. dry stock
F_2	Free moisture content of dried product, lb./lb. dry stock
G	Flow rate of drying gas stream, lb. dry gas/hr.
H	Absolute humidity of air, lb. water/lb. dry air
H_a	Humidity of drying gas stream, lb. vapor/lb. dry gas
H_c	Humidity of drying gas stream in contact with material at critical moisture content, lb. vapor/lb. dry gas
H_s	Saturated humidity at wet-bulb temperature, lb. vapor/lb. dry gas
H_1	Humidity of drying gas stream entering dryer, lb. vapor/lb. dry gas
H_2	Humidity of drying gas stream leaving dryer, lb. vapor/lb. dry gas
h_c	Local convection heat transfer coefficient, Btu./(hr.)(sq. ft.)(F.)
h_r	Local radiation heat transfer coef., Btu./(hr.)(sq. ft.)(F.)
K	R_c/F_c, a function of the constant drying rate
k	Thermal conductivity of a solid body, Btu./(hr.)(sq. ft.)(F./ft.)
k_g	Coefficient of mass transfer, based on partial pressure difference, lb./(hr.)(sq. ft.)(atm.)
k_g'	Coefficient of mass transfer, based on humidity difference, lb./(hr.)(sq. ft.)(lb. vapor/lb. dry gas)
k_m	Thermal conductivity of a mixture of gas and vapor, Btu./(hr.)(sq. ft.)(F./ft.)
M	Total moisture content, lb./lb. dry stock
M_A	Molecular weight of non-condensable gas
M_B	Molecular weight of pure vapor
M_c	Total moisture content at critical point, lb./lb. dry stock
M_e	Equilibrium moisture content, lb./lb. dry stock
P	Vapor pressure of pure liquid, atm.
P_a	Partial pressure of vapor in drying gas stream, atm.
P_s	Vapor pressure of pure liquid at wet-bulb temperature, atm.
q	Rate of heat flow, Btu./hr.
R	Psychrometric ratio, $h_c/k_g' c_s$
R_c	Rate of drying during constant-rate period, lb./(hr.)(sq. ft.)
t_a	Dry bulb temperature of drying gas stream, F.
t_d	Dew point of drying gas stream, F.
t_k	Temperature of a source of conductive heat, F.
t_r	Temperature of a source of radiating heat, F.
t_s	Temperature of wet surface, F., or the wet bulb temperature which is equal to the adiabatic saturation temperature only if $R = 1$
t_{s1}	Wet bulb temperature at inlet conditions of dryer, F.
t_{s2}	Wet bulb temperature at outlet conditions of dryer, F.
t_1	Dry bulb temperature of gas entering dryer, F.
t_2	Dry bulb temperature of gas leaving dryer, F.
U	Over-all heat transfer coefficient, Btu./(hr.)(sq. ft.)(F.)
V	Velocity of gas flowing over drying surface or, for through-circulation drying, the superficial gas velocity, ft./hr.
V_A	Molecular volume of non-condensable gas (p. 538, Perry's Handbook, 3rd. Ed.)
V_B	Molecular volume of condensable vapor (p. 538, Perry's Handbook, 3rd. Ed.)
W	Weight of free water present in stock, lb.
W_d	Weight of dry stock, lb.
W_1	Initial weight of free water in stock, lb.
W_2	Final weight of free water in stock, lb.
w	Vaporization rate, lb./hr.
x	Distance in direction of flow of heat by conduction, ft.
ϵ	Emissivity, dimensionless
θ_c	Drying time for constant-rate period, hr.
θ_f	Drying time for falling-rate period, hr.
ΔP	Finite vapor pressure difference, atm.
Δt	Temperature difference, F.
ρ	Density of air stream, lb./cu. ft.
μ	Viscosity of air stream, lb./(ft.)(sec.)
λ_s	Latent heat of evaporation at t_s, Btu./lb.

Drying Equation Derivations, *continued*

tion (21) that the drying rate can theoretically be increased 75% by doubling the air velocity. Eqs. (22) and (23) show that, in general, higher drying rates are also obtainable when air is blown perpendicular to the surface or passed through a bed of subdivided solids.

Falling-Rate Period

From qualitative discussions, p. 193, *Chem. Eng.*, Oct. 1955, it is evident that the drying rate during the falling-rate period may be a complex function of many factors which may or may not be interrelated. However, in the majority of drying applications it has been found that the combined effect of the various factors is a linear function of the water content of the material. Therefore, the rate of moisture removal during this period of drying can usually be expressed with reasonable accuracy as

$$dW/A_f\,d\theta_f = -K(M - M_e) = -KF \qquad (24)$$

That portion of the curve representing the falling-rate period may actually have a curvature concave upwards or downwards but in general will approximate a straight line relationship. Under constant drying conditions, Eq. (24) can then be integrated as follows:

$$dW/A_f\,d\theta_f = -KF \qquad (25)$$

$$K = R_c/F_c \qquad (26)$$

$$dW = W_d\,dF \qquad (27)$$

$$-dF/F = (R_cA_f/F_cW_d)\,d\theta_f \qquad (28)$$

$$A_f = -\frac{F_cW_d}{\theta_fR_c}\int_{F_1}^{F_2}\frac{dF}{F} = \frac{F_cW_d}{\theta_fR_c}\ln\frac{F_1}{F_2} \qquad (29)$$

where

$$R_c = k_g'(H_s - H_a) = \frac{h_c(t_a - t_s)}{\lambda_s} \qquad (30)$$

So

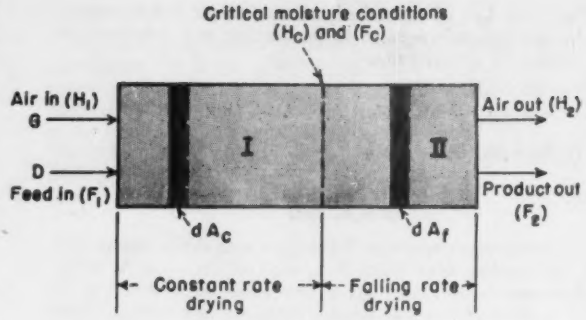
$$A_f = \frac{\lambda_s F_cW_d}{\theta_f h_c(t_a - t_s)}\ln\frac{F_1}{F_2} \qquad (30a)$$

Variable Drying Conditions

Certain equations to follow will be presented for variable drying conditions which are frequently encountered in practice or are readily amenable to treatment by applying the equations for constant drying conditions to a differential section of the dryer and integrating them between known limits. Algebraic solutions can be worked out for those cases in which the operating line is coincident with a constant wet bulb temperature line. Other situations can best be treated by graphical integration, since the driving force then becomes a function of two variables, H_s and H_a, which cannot be readily expressed in terms of one or the other. The various cases considered are as follows:

1. Adiabatic Counterflow Dryer ($R = 1$)
2. Adiabatic Parallel Flow Dryer ($R = 1$)
3. Intermittent Adiabatic Dryer ($R = 1$, and complete mixing of the charge and operation above the critical value of moisture content assumed).
4. Non-Adiabatic Counter Flow Dryer ($R = 1$ and/or slope of operating line not equal to that of constant wet bulb temperature line).
5. Non-Adiabatic Parallel Flow Dryer ($R = 1$ and/or slope of operating line not equal to that of constant wet bulb temperature line).

As an example of a typical derivation, the case of the adiabatic parallel flow dryer, will now be considered in detail for a system having a psychrometric ratio of unity. Pertinent conditions within the dryer are indicated diagramatically as follows: Section I to



the left of the dotted line represents the zone in which the moisture content of the material is above the critical value and for simplicity it will be assumed that the material enters this zone at its wet bulb temperature. The rate of drying at any point in this section of the dryer can now be represented by the differential form of Eq. (6):

$$dw = k_g'(H_s - H_a)\,dA_c \qquad (31)$$

However, dw is equivalent to GdH_a, the amount of moisture picked up by the air, and hence

$$A_c = \frac{G}{k_g'}\int_{H_1}^{H_c}\frac{dH_a}{H_s - H_a} = \frac{G}{k_g'}\ln\frac{H_s - H_1}{H_s - H_c} \qquad (32)$$

From a water balance over Section I, it follows that

$$H_a = H_1 + (D/G)(F_1 - F_c) \qquad (33)$$

Eq. (32) can thus be rearranged and expressed as follows:

$$A_c = \frac{G}{k_g'}\ln\frac{1}{1 - \frac{D}{G}\left(\frac{F_1 - F_c}{H_c - H_1}\right)} \qquad (34)$$

For Section II, where the moisture content of the material is less than the critical value, Eq. (25) can be rewritten and combined with Eqs. (26) and (30) to represent the differential drying rate as shown below:

$$\frac{dW}{d\theta_F} = -dw = -\frac{k_g'(H_s - H_a)F}{F_c}\,dA_f \qquad (35)$$

or

$$dA_f = \frac{F_cG}{k_g'(H_s - H_a)F}\,dH_a \qquad (36)$$

From a water balance over the section between the point in question and the end of the dryer,

$$F = F_2 + (G/D)(H_2 - H_a) \qquad (37)$$

Therefore,

$$dA_f = \frac{F_cG}{k_g'(H_s - H_a)[F_2 + (G/D)(H_2 - H_a)]}\,dH_a \qquad (38)$$

$$A_f = \frac{F_cG}{k_g'}\int_{H_c}^{H_2}\frac{1}{(H_s - H_a)[F_2 + (G/D)(H_2 - H_a)]}\,dH_a \qquad (39)$$

$$A_f = \frac{F_cG}{k_g'}\left[\frac{1}{F_2 + (G/D)(H_2 - H_a)}\right] \times \ln\frac{F_2 + (G/D)(H_2 - H_a)}{H_s - H_a}\Bigg|_{H_c}^{H_2} \qquad (40)$$

From Eq. (37), it follows that

$$F_e = F_2 + (G/D)(H_2 - H_e) \quad (41)$$

or

$$H_e = H_2 - (D/G)(F_e - F_2) \quad (42)$$

Also from an over-all water balance,

$$H_2 = H_1 + (D/G)(F_1 - F_2) \quad (43)$$

The latter three equations may be combined with Eq. (40), which then will take the following form when integrated between the indicated limits:

$$A_f = \frac{G}{k_g'}\left[\frac{1}{\frac{F_1}{F_e} - \frac{G}{D}\left(\frac{H_e - H_1}{F_e}\right)}\right] \times \ln \frac{F_2}{F_e}\left[\frac{1 - \frac{D}{G}\left(\frac{F_1 - F_e}{H_e - H_1}\right)}{1 - \frac{D}{G}\left(\frac{F_1 - F_2}{H_e - H_1}\right)}\right] \quad (44)$$

Rearrangement and substitution of Eq. (18) will yield the following forms of Eqs. (34) and (44):

$$A_s = GR\left(\frac{c_s}{h_c}\right) \ln \frac{1}{1 - \frac{D}{G}\left(\frac{F_1 - F_c}{t_1 - t_s}\right)\left(\frac{1}{R}\right)\left(\frac{\lambda_s}{c_s}\right)} \quad (45)$$

$$A_f = GR\left(\frac{c_s}{h_c}\right)\left[\frac{1}{\frac{F_1}{F_c} - \frac{G}{D}\left(\frac{t_1 - t_s}{F_c}\right)\left(\frac{Rc_s}{\lambda_s}\right)}\right] \times \ln \frac{F_2}{F_c}\left[\frac{1 - \frac{D}{G}\left(\frac{F_1 - F_c}{t_1 - t_s}\right)\left(\frac{1}{R}\right)\left(\frac{\lambda_s}{c_s}\right)}{1 - \frac{D}{G}\left(\frac{F_1 - F_2}{t_1 - t_s}\right)\left(\frac{1}{R}\right)\left(\frac{\lambda_s}{c_s}\right)}\right] \quad (46)$$

The latter forms of the integrated drying equations are somewhat more convenient and accurate for use in the higher temperature ranges in particular.

A summary of the drying equations for different methods of dryer operation is given in Table I. In practice, it is possible that a given material may be subjected to drying only above or below its critical moisture content. Separate equations have thus been presented to cover both zones of possible operation. However, it should be pointed out that if only one zone is involved, the values of F_c, other than that which is contained ahead of the integral signs or the logarithmic terms, become equal to F_s or F_f depending on whether the drying operation takes place above or below the critical moisture content, respectively.

Constant Temperature Drying

One additional case of a specific type of dryer operation is worthy of mention in that it can be represented by an algebraic expression with reasonable accuracy. This case involves constant temperature drying (via addition of heat to air to replace that used to vaporize the water) with reference to an air-water vapor system. The following equation can be developed for this method of operation above the critical moisture content on the assumption that the saturated humidity vs. temperature curve can be closely approximated by a quadratic equation over a range of wet bulb temperatures from 70 F to 140 F:

$$A_s = 0.055\left(\frac{G}{h_c}\right)\left[(t_s - 63)\ln\frac{t_s - t_{s1}}{t_s - t_{s2}} - (t_{s2} - t_{s1})\right] \quad (47)$$

where t_{s1} and t_{s2} designate the wet bulb temperatures corresponding to the humidity of H_1 in the inlet hot air stream and the humidity of $H_1 + (D/G)(F_1 - F_s)$ in the exit air stream or stack gases, respectively.

is chosen independently of the calculation of the area to be exposed and is expected to insure the desired performance.

If the material is placed too thickly, such that the actual critical moisture is greater than that assumed or the falling rate plot is concave upwards rather than a straight line, then more time or more area, among other things, will be needed to accomplish the drying.

Critical moistures may be estimated for drying calculations but the engineer should be aware of the effect such factors as thickness, humidity and air velocity have on these moistures. Even the simplest drying tests, to determine roughly the variation of critical moisture with thickness, will greatly increase the reliability of all subsequent calculations.

The engineer should also bear in mind that even though the selected thickness and the calculated area give the expected performance, it may well be possible to increase the thickness of the bed without increasing, in as great a degree, the area necessary for drying (because critical moisture and falling rate are less influenced). The net effect is that the same drying surface will permit the drying of more material, all else being equal.

In through-circulation drying, S would correspond to the total particle surface per cu. ft. of dry stock volume. For non-spherical particles, the value of S in this case can be estimated by means of the following relationship:

$$S = 6(1 - \epsilon)/\phi_s D_p \quad (10)$$

where ϵ = porosity, that is volume of the void space/total volume of dry stock, and ϕ_s = shape factor, dimensionless.

Some typical values for fixed bed voidage or porosity, and shape factor are summarized in Tables III and IV, respectively, as reported in the literature. Finally, the nominal retention time—weight holdup/D—is given by

$$\text{Retention time} = \rho_b A_t / DS \text{ hr.} \quad (11)$$

Once the question of allowable gas velocity and holdup or retention time has been settled, the proper size of the

Fixed Bed Voidage or Porosity (ϵ)—Table III

Material	Size Range	ϵ
Anhydrite	20–100 mesh	0.37–0.44
Berl saddles	0.6 cm.	0.69–0.83
Catalyst pellets	Length = diameter	0.32, lower limit
Coal	20 mesh	0.41
	Under 120 mesh	0.32
Cubes	0.56 cm. side	0.34–0.45
Cylinders	3/8 in. dia. x 3/4 in. long	0.43–0.48
	1/2 in. dia. x 1/2 in. long	0.36–0.41
	3/8 in. dia. x 3/8 in. long	0.39
Powder	Very wide range of sizes	0.20, lower limit
Prism, hexagonal	0.47 cm. dia. x 0.48 cm.	0.38–0.43
Quartz, broken	1/4–1/8 in.	0.46
Sand, coarse	20–30 mesh	0.36–0.44
coarse, flat particles	20–30 mesh	0.42–0.50
fine	100–150 mesh	0.40–0.48
flint, flaky	60 mesh	0.45–0.54
Silica powder	2–80 microns	0.37–0.49
Slate, black powder	2–80 microns	0.57–0.66
Spheres	Uniform size (any dia.)	0.35–0.42

Shape Factor (ϕ_s)—Table IV

Material	Nature of Grain	ϕ_s
Perfect spheres		1.00
Ottawa sand	Nearly spherical	0.95
Tungsten powder		0.89
Flue dust	Fused, spherical	0.89
Sand	Rounded	0.82
Sand	Angular	0.73
Sand	All types, avg.	0.75
Pulverized coal		0.73
Cork		0.69
Flint sand	Jagged	0.66
Crushed glass	Jagged	0.65
Natural coal dust	(up to 3/8 in.)	0.65
Wilcox sand	Jagged	0.60
Flue dust	Fused aggregates	0.55
Flint sand	Jagged flakes	0.43
Fusion fibers		0.38
Mica	Flakes	0.28
Arnould's wire spirals		0.2
Berl saddles		0.3

drying chamber must be determined to comply with these limitations. In the case of batch drying, a proper selection of cycle time must also be made. This choice may be dependent on process limitations ahead of or after the drying step, or it may come from an economic consideration of what condition yields the lowest total operating cost. Most important of all, the dryer selected must assure satisfactory performance with minimum operating interruptions.

The exact method of translating A_t, the area which must be exposed to drying, and the allowable gas velocity and retention time into characteristic dryer dimensions varies with the form, shape or arrangement of the type of dryer under consideration. This method may involve a relatively simple calculation—as for a cabinet or tunnel dryer in which material presents a nearly constant surface to the drying medium and retention time is controlled rather simply by mechanical means. Or it may be a complex relationship—as for a rotary dryer in which rotational speed, pitch of the dryer shell, the action of lifting flights (which disperses the solids in the drying medium), and other variables, all affect performance.

Sometimes a calculation of the exposed drying surface, A_t, may be bypassed, as in designing a fluid bed dryer. A necessary air volume is calculated from heat balances and a necessary air velocity to obtain fluidization (thus insuring contact of the total surface of all particles by the drying medium) is arrived at. Finally, a drying chamber diameter is determined which will permit the desired air flow and at the same time obtain the minimum velocity for fluidization. Curves relating diameter to cost can then be consulted.

Even in the case of the fluid bed dryer the area may ultimately have to be reckoned with, however, for the area, together with S, the available surface per cubic foot of material, determines the necessary retention time of the solids in the drying medium. The diameter, which was calculated in order to size the dryer and determine its cost, may permit enough air at sufficient velocity to carry water away. But the water may not be readily available, the internal moisture may not be diffusing rapidly enough to the surface of the suspended particles to take advantage of the drying medium's capacity. If this is the case, then either the particle size must be reduced to increase diffusion or, if this is not possible, the retention time increased. The latter adjustment may require higher feed rates and/or a larger fluid bed to insure longer contact time between drying solids and drying medium.

At any rate there are many courses to follow in projecting calculated values to a specific dryer size and design, for there are many kinds of dryers. To bridge this gap in detail for all the different kinds of dryers would entail a lengthy discussion beyond the scope of this report.

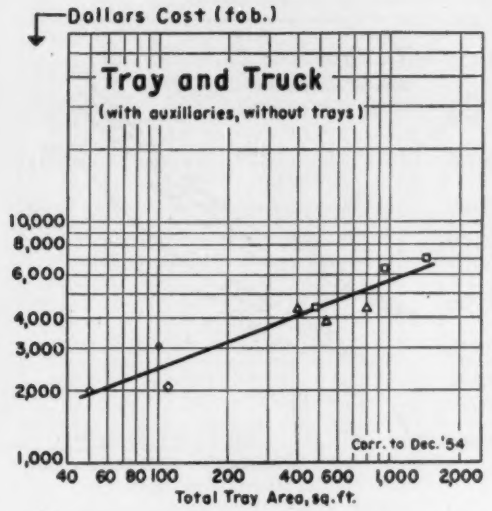
Estimation of Costs

Costs of drying operations vary over a considerable range, from about 0.03 to 3¢/lb. of product, depending on the type of drying treatment used and the capacity involved. The chief items going to make up these costs are the fixed

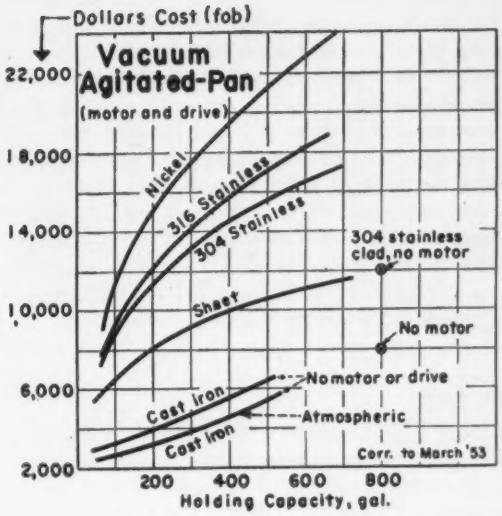
For Estimating Installed Cost of Dryers – Table V

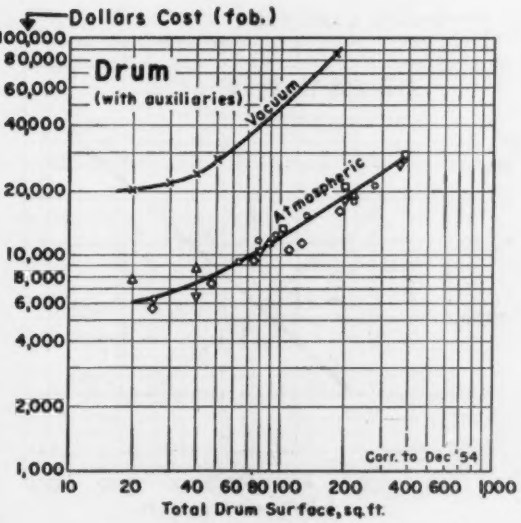
1. Fob. cost	From previous experience, from manufacturers' estimates, or from curves, tables, data, and theory in this article and other literature.
2. Taxes	2% of fob. cost.
3. Insurance	Negligible compared to other costs.
4. Freight	[0.0139 + (0.0000418 × miles)] × fob. cost for mild steel construction.
5. Space occupied	Negligible for outside installation. 7% of mild steel fob. cost for inside installation.
6. Labor of installation	Estimate for each case or use 150% item (7).
7. Materials for installation	Estimate for each case or use 67% item (6).
8. Indirect construction expense	50% of item (6).
9. Contingencies	12½% of items 1, 5, 6, and 7. (Do not include item (5) unless new construction is necessary.)
10. Contractor's fee	15% of items 1, 5, 6, and 7. (Do not include item (5) unless new construction is necessary.)

Total = 123 to 153% of fob. cost + 230 to 265% of labor of installation.



○ Tray – includes insulated aluminum panel construction on a steel framework, built-in racks, steam heating coils, fan, and motor; but does not include temperature controls.
□ Truck – includes insulated aluminum panel construction on a steel framework, steam heating coils, fan, motor, and automatic temperature control; but does not include trucks.
◇ Tray – includes fan, motor, and heater. Ref. 1.
△ Truck – includes fan, motor, and heater. Ref. 1.



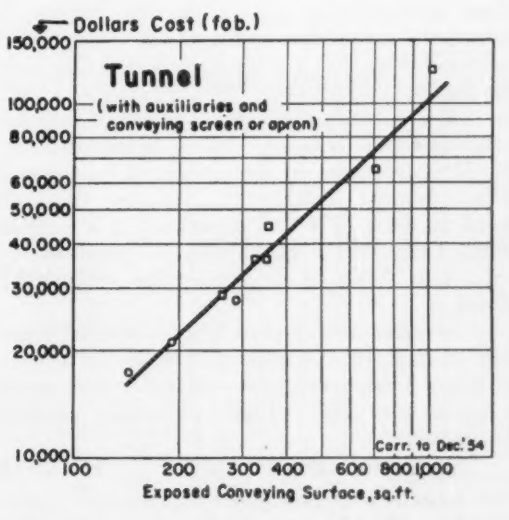


○ Double-drum – includes valley feed and doctor knife assemblies, rotary steam and water joints, and scrapers, and side conveyors or chutes.
◇ Single-drum – includes dip feed pan and doctor knife assembly, rotary steam and water joints, and scrapers, and side conveyor or chute.
▽ Double-drum – includes galvanized conveyors and vapor hoods. Ref. 1.
□ Double-drum – includes motors and feed conveyors. Ref. 4.
△ Single-drum – includes motors and feed conveyors. Ref. 4.
× Vacuum single-drum – includes motors and receivers. Ref. 4.

The curve for atmospheric equipment is approximate for single-drum, double-drum, and twin-drum. The curve for vacuum equipment has been derived from single-drum data, but probably can be applied to any vacuum drum equipment.

If the drum is chrome plated, add $24/sq. ft. for drum areas below 185 sq. ft. Add $36.50/sq. ft. for greater areas. If variable speed motor drive is included, add 10%.

Multiply f.o.b. cost by 2 for a rough estimate of installed cost.



○ Includes insulated aluminum panels on steel framework, stainless steel conveying apron, steam heating coils, fans, motors, drives, and automatic temperature controls.
□ Includes fans, motors, heaters, temperature controls, and other auxiliaries. Ref. 1.

charges such as depreciation, insurance, taxes and interest; and the direct operating costs such as fuel and power, operating labor, maintenance and other utilities.

A number of these factors are ordinarily estimated as a percentage of installed cost, so our first task is to get on to the estimation of dryer fob. and installed costs. We have already discussed the listing of dryers capable of handling the material (Part I), and found how to estimate fuel needs and necessary drying surface. We can determine roughly how large a dryer of each suitable type is needed to provide this surface. The remaining problem, then, is to eliminate the high-cost dryers by a comparison of the economic factors for each.

Dryer Cost

As a first approximation of dryer cost it has been found possible to correlate cost with heating medium temperature and evaporation capacity. From earlier discussions it can be inferred that dryer cost varies in a general way inversely as the temperature of the heating medium, and directly with evaporation capacity. This conclusion has been verified by plotting the available cost data on all types of dryers against the ratio w/T. The following equation results:

$$C = 3{,}000(1 + w/T)(I/100) \qquad (12)$$

where C is installed cost in dollars covering the dryer and auxiliaries, with foundations and erection, but no dewatering equipment, steam generation equipment, secondary dust collectors, or building; w is the evaporation capacity, lb. moisture/hr.; T is air inlet or heating medium temperature, F.; and I is the Marshall & Stevens Equipment Cost Index for the chemical industry (185.7 for Dec. 1954).

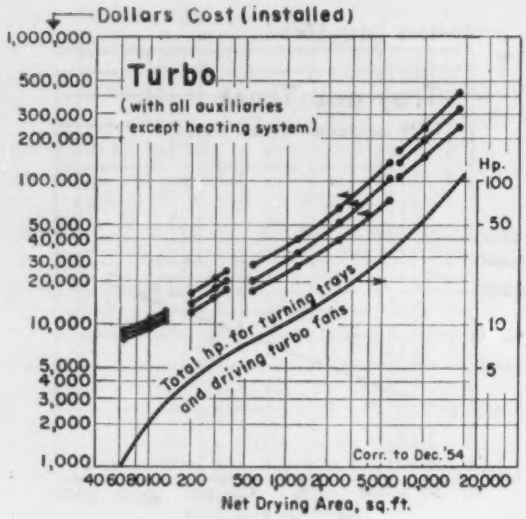
Eq. (12) is approximately correct for normal situations, but the costs thus calculated should be adjusted from 0 to ±20% depending on the anticipated limitations of material behavior. Furthermore, the cost should be increased by about 70-90% if indirect drying is necessary, 80-100% if clad steel or special alloy-steel construction is required, and 10-15% if abrasion-resistant steel must be employed.

Since the factor w/T appears to be a reasonably good criterion of dryer size, it is also logical to attempt a general correlation of horsepower requirements versus this quantity. This type of plot yields the following average expression for horsepower:

$$\text{Hp.} = 12w/T \qquad (13)$$

Further corrections of horsepower requirements as calculated by Eq. (13) must be made depending on the degree of mechanical complexity of the dryer, the use of auxiliary crushing facilities and high efficiency dust collection equipment in the circuit, the operating back pressure on the air circulation system, the physical properties of the material, etc. The correction involved may range from 0 to ±50%.

Since power varies considerably with the material and the class of drying equipment employed, the application of Equation (13) requires some practical judgment on the choice of a suitable correction factor in accordance with the anticipated limitations of the system. For example, the power requirement for a pneumatic conveyor or fluidized



Top curve is for type 304 stainless steel construction, the middle curve is for aluminum, and the bottom is for steel or steel and transite. All curves include variable speed drives, totally enclosed motors, and insulation.

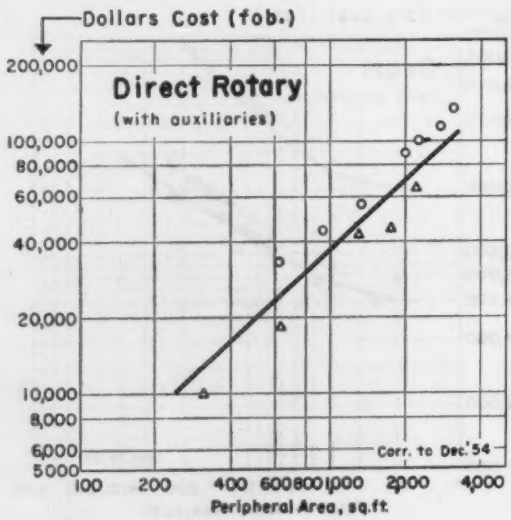
Add 20-30% for internal heaters and 10-20% for external heaters.

Dryers with less than 400 sq. ft. of drying area are package units and are shipped completely assembled for indoor installation. They require no foundations and can be placed on ordinary flooring.

Dryers with more than 400 sq. ft. of drying area must be erected in the field. Add 20-30% to the curve for foundations and erection charges.

Costs shown for drying areas above 6000 sq. ft. are for outdoor installations. For outdoor installations with 500 to 6000 sq. ft. of drying area, add approximately 20% to the curve.

Data from Wyssmont Co.

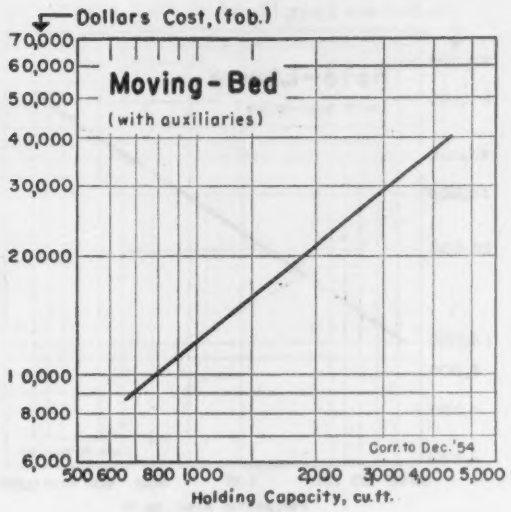


△ Hardinge Co.

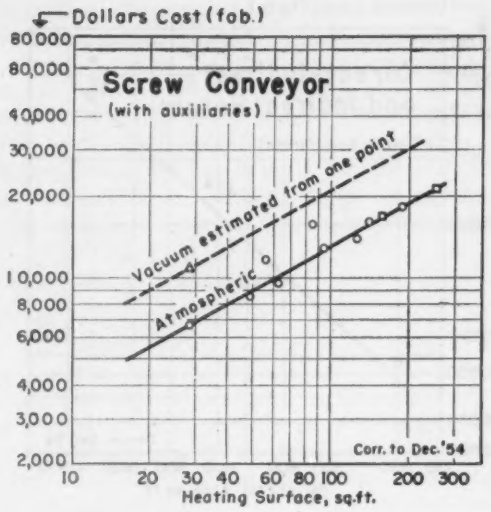
○ Includes induced draft fan, stack, cyclone type dust collector, oil burner, feeder, and instrumentation.

Add 100 to 200% for stainless steel or other special alloy construction.

Multiply f.o.b. cost by 1.5-2.5 for a rough estimate of installed cost.



Multiply f.o.b. cost by 1.5-2.5 for a rough estimate of installed cost.



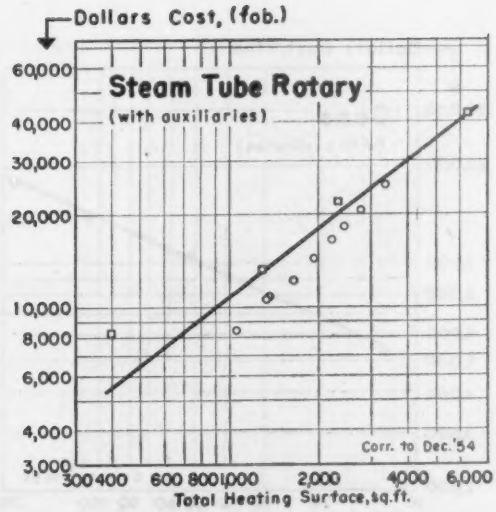
O Includes motor and drive.

□ Includes motor and drive, pedestals, piping connections, sight glasses, and removable dams. Acme Coppersmithing and Machine Co.

△ Includes motor and variable speed drive, pedestals, piping connections, sight glasses, screw feeder, product discharge screw, condenser, receiver, decanter, steam jet air ejector (single stage), solvent pump, and tail box. Acme Coppersmithing and Machine Co.

Add 35% for type 304 stainless steel construction.

Multiply f.o.b. cost by 2-3 for a rough estimate of installed cost.

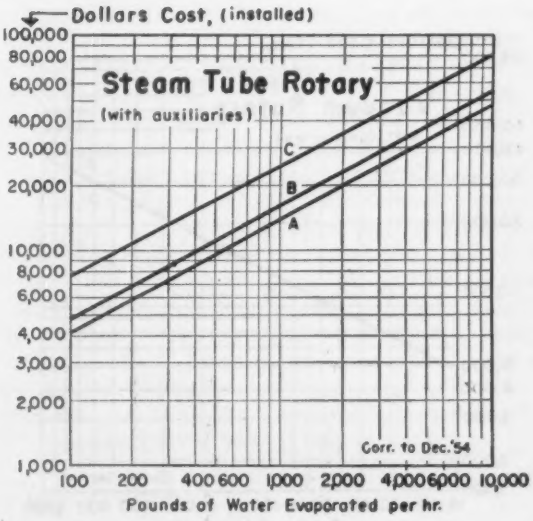


□ Includes only those items required to operate dryers. Louisville Drying Machinery Unit, General American Transportation Corp.

O Includes motor and drive, intake hopper, discharge hood, 40-foot stack, rain hood, roof collar, and manually operated damper. Davenport Machine & Foundry Co.

For 304 stainless steel clad shell and 304 stainless steel flights and tubes, add 85%. For 316 stainless steel clad shell and 316 stainless steel flights and tubes, add 125%. For other alloys and combinations, from 30 to 200% may have to be added to the curve.

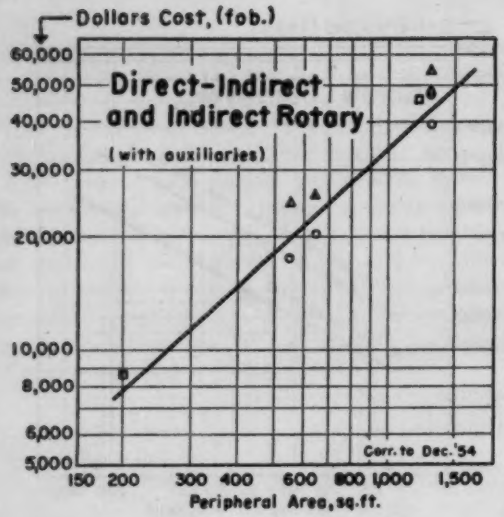
Multiply f.o.b. cost by 2 for a rough estimate of installed cost, or see next graph.



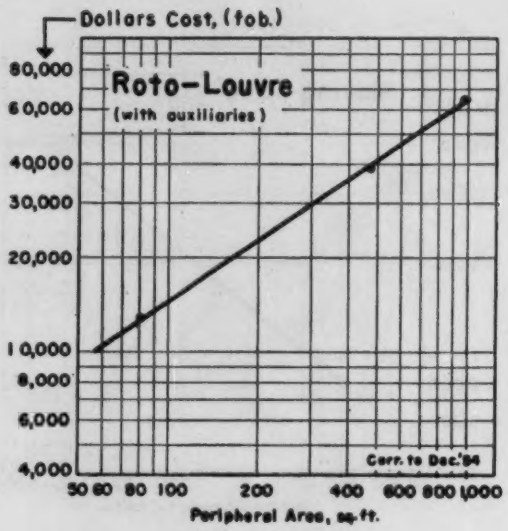
A. Organic and other high moisture materials.

B. Finely divided, free-flowing solids dried to about 0.5% moisture.

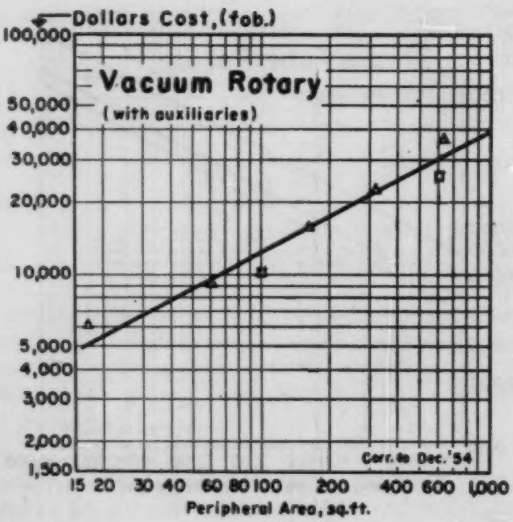
C. Pigments, filter cakes, pasty materials, etc., dried to very low final moisture contents. Steel construction throughout. Louisville Drying Machinery Unit, General American Transportation Corp.



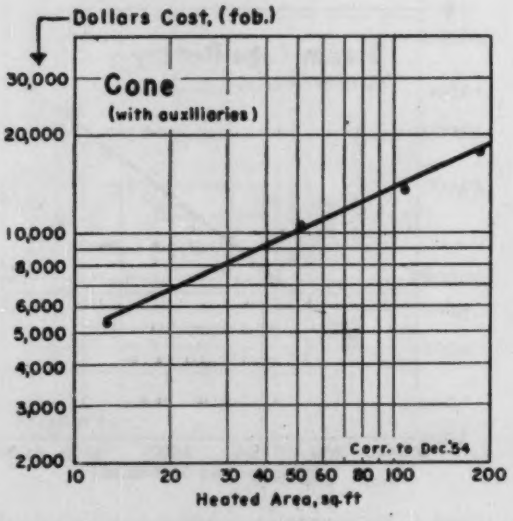
△ Hardinge Co.
○ Ref. 1.
□ Includes motors, cyclones, and heating equipment. Ref. 4.
Add 50 to 200% for stainless steel or other alloy construction.
Multiply f.o.b. cost by 1.5–2.5 for a rough estimate of installed cost.



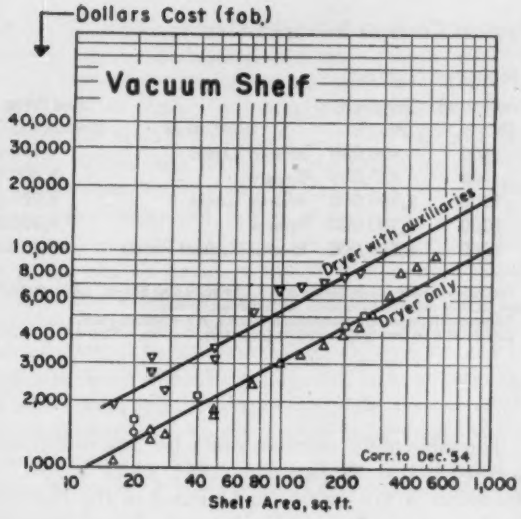
Includes heater or steam coil, dust collectors, fans, motors, drives, and controls. Link-Belt Co.
Multiply f.o.b. cost by 1.2 for a rough estimate of installed cost.



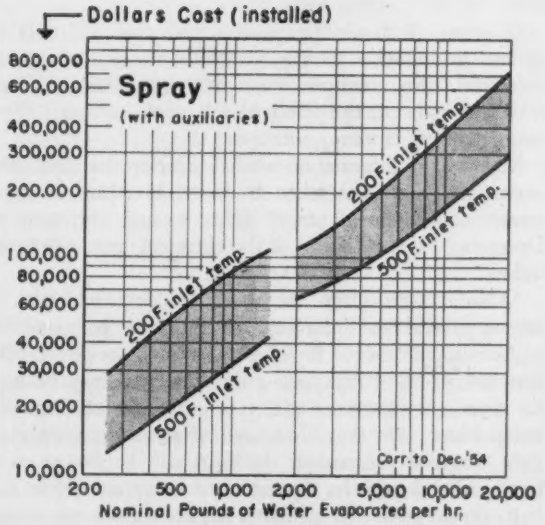
△ Includes motor and drive, vacuum pump, dry dust filter, condenser, and receiver.
□ Includes vacuum pump and condensers. Ref. 4.
Add 65% for 304 stainless steel construction and from 50 to 200% for other stainless steel or alloy construction.
Multiply f.o.b. cost by 1.5–3.0 for a rough estimate of installed cost.
Working capacity: about 50–60% of dryer free volume.



Includes butterfly valve, support stand, drive, chain guard, bleed valve, single speed motor, and glassed-steel inner surfaces. Pfaudler Co.
Add $500 to $1,500 for vacuum equipment.
Working capacity is usually about 60% of total capacity but may vary from 25–65%.



△ Dryer only.
□ Without accessories. Ref. 4.
▽ Includes condensers, receivers, and vacuum pumps.
○ Includes condensers, motors, and vacuum pumps. Ref. 1.



Higher cost may be due to one or more of the following conditions: low inlet temperature, e.g., 300 – 400°F.; coarse atomization; indirect heat; and special materials of construction.

The data for evaporation rates above 2,000 lb./hr. were taken from Ref. 1. Costs are for ordinary steel construction with furnace, dust collectors, atomizer and spray machine, fans, and motors included.

Costs for evaporation rates below 2,000 lb./hr. do not include the heat source. Western Precipitation Corp.

bed dryer may be expected to be about 40 to 50% greater than that predicted by Eq. (13).

A word of caution relative to the use of both Eqs. (12) and (13): often a cooling operation may be closely integrated into a drying system, such as a fluid-bed dryer consisting of two superimposed compartments. In such cases additional costs will be incurred. Probably, the safest practice would be to consider cooling as a separate unit operation in the preparation of preliminary cost estimates.

Interpreting Dryer Costs

More accurate estimates than those possible with Eq. (12) are required for the comparison of individual dryers. They must be based on the components which make up the installed cost. These have been listed in Table V as the fob. cost of the dryer with all of its auxiliaries, plus taxes, insurance, freight, charges for the space occupied by the drying unit, labor of installation, charges for the materials used to complete the installation, indirect construction expense, contingencies, and the contractor's fee. None of these is easy to determine and company records for similar installations should be used to estimate the installed cost if at all possible. When no similar installations have been made, the meager literature must be relied upon or the dryer manufacturer must be consulted.

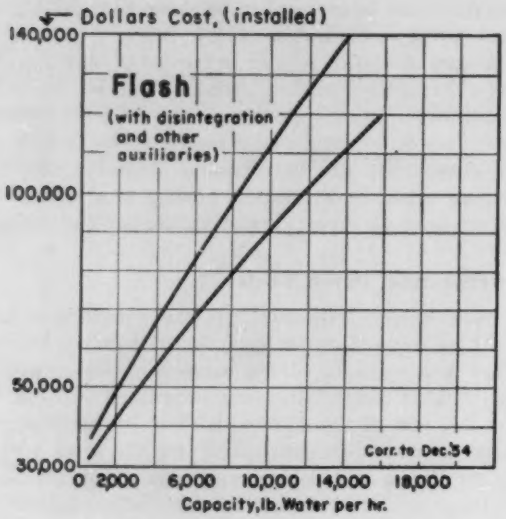
The data in the literature have no common basis. Both installed and fob. costs with and without auxiliaries can be found; but because the installation costs can vary, the fob. cost with all auxiliaries has been selected as the basis for the curves given here although in a few cases installed costs have been used. The installed cost can be approximated through use of a factor given with each curve; or it can be estimated more accurately by adding the charges for taxes, insurance, freight, space required, labor or installation, materials to complete the installation, etc.

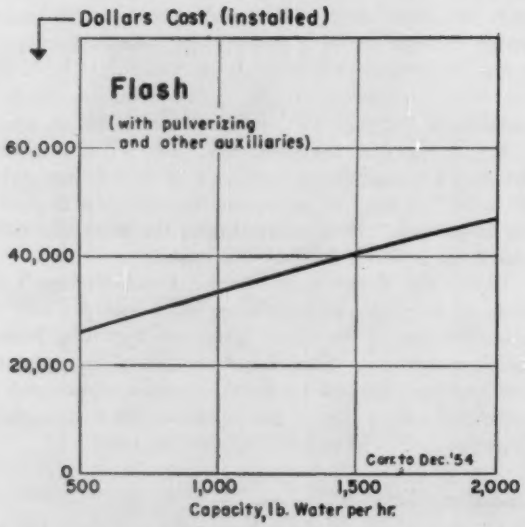
It may appear to the reader that there is a contradiction between a manufacturer's estimate of installation costs—10 to 20% of the fob. price—and the estimates implicit in the conversion factors accompanying the dryer cost curves and listed in Table VIII of this report.

Here's why there's a difference. A manufacturer's estimate of erection and installation costs includes only the major portion of the direct labor and materials, items 6 and 7 in Table V. However, when the indirect construction expenses, the charges for the space occupied, and the other items in Table V are included, the total installed costs run from 150 to 300% of the fob. prices.

Updating Cost Data

Another factor which in the past has limited the usefulness of data in the literature has been the change in prices and costs with time, but that factor can be eliminated in large part through the use of suitable indexes to update the information in the literature. The index selected for use here is the Marshall & Stevens Index of Comparative Equipment Costs for the chemical process industry. This index is especially useful to readers of *Chemical Engineering* because the current index appears in each issue of this magazine in the Process Equipment News section.





Direct heat: inlet air temperature of 1,200-1,300 F. These costs will increase as a lower inlet air temperature is used.
Subtract 12-18% for drying without disintegration.
Add 60 to 100% for special alloy-steel construction.

Typical Costs of Infrared Dryers

Moisture Evaporated, (lb./hr.)	Heat Supplied, (Btu./hr.)	Heat Source	List Price, Uninstalled ($)
160	400,000	Infrared Lamps	468.00†
160	400,000	Burners	2,300.00*
1000	2,500,000	Infrared Lamps	2,928.00†
1000	2,500,000	Burners	4,320.00*
1000	2,500,000	Electric Radiant Panels	16,156.80

* Includes electric pilots, burner mixers, combustion air blower, safety shut-off gas valve, control switches, transformer, and other auxiliaries.
† Lamps only; does not include bases, wiring, and mounting panel.
Calculated from data supplied by Red-Ray Mfg. Co., Inc.—Aug. 1954.

The value of the index on which the data in this article is based is that for December 1954, which is 185.7. A discussion of this index[8] can be found in the November, 1947, issue of *Chemical Engineering*. Values from 1913 to 1954 are given in the March 1955 issue.[9]

The Marshall & Stevens Index strictly should be applied only to installed costs, but it usually gives satisfactory results when used to update fob. prices. The index for the chemical industry has been used here, but the "average of all" index probably is equally satisfactory. For example, one dryer manufacturer reported remarkable correlation in checking prices between 1939 and 1952 with the Marshall and Stevens "average of all" index. The maximum deviation on units checked was 5%, but in most cases the error was only 1 or 2%. Other manufacturers reported that deviations were within 10%.

However, it should be pointed out that attempts to update information in the literature are not always so successful. For example, when data from Perry's Handbook are updated, the resultant fob. costs may vary from manufacturers' current quotations.

Most of the information used to develop the dryer cost curves and chart was taken from the literature, or from recent data obtained from industry, and corrected to December 1954, by means of the chemical process industry index.

Manufacturers often are understandably reluctant to release general cost information because of the possibility of its misapplication. If prices are quoted on heavy, fully instrumented and equipped units, the costs may be high for certain applications and apparently out of line with competitors. On the other hand, if prices are quoted on light, stripped equipment, the costs will be low in most cases and will gain the reputation of being unreliable.

Really accurate cost estimates require a thorough knowledge of the application in mind and of the possible variations in the components of the dryer. Therefore, highly accurate estimates are complicated to prepare and usually should be left to the manufacturer; but for preliminary estimates the data and methods presented here should be satisfactory even though some accuracy has been sacrificed for simplicity.

Probably the most difficult step to perform accurately in the preliminary selection of a dryer is the estimation of the dryer size. Pilot plant data are necessary for a close approx-

imation, but often a rough estimate is required before the time and expense of experimental work can be justified. Then, if the same or similar material has been dried previously within the plant, the company records should be consulted for operating data on which to base the size required. When such first-hand information is not available, dryer manufacturers and the literature must be consulted. The tables and theory presented in these two reports are expected to aid in such cases. Additional data and theory can be found in the literature—especially in the "Chemical Engineers' Handbook."

In a few cases, the dryers are sufficiently limited in the types of material handled so that a cost estimate can be based directly on desired capacity, but in most cases the cost curves have been based on physical dimensions which must be determined from the material to be dried and the capacity desired.

Cost curves for specific dryers are found on pp. 187-192 of this report.

The fob. and installed cost of those dryers for which no cost curves have been presented here must be estimated from data in the Tables V and VIII and text of this article and other literature.

Breakdown of Installed Costs

After an fob. cost has been estimated, the remaining items making up the installed cost can be approximated without much difficulty because they will be roughly proportional to that cost. The items making up the installed cost have been listed in Table V together with rough estimates of the value of each.

Sales taxes may or may not be charged depending upon the state in which the sale is made and the state to which the unit will be delivered. When such taxes are paid they will amount to about 2% of the sale price.

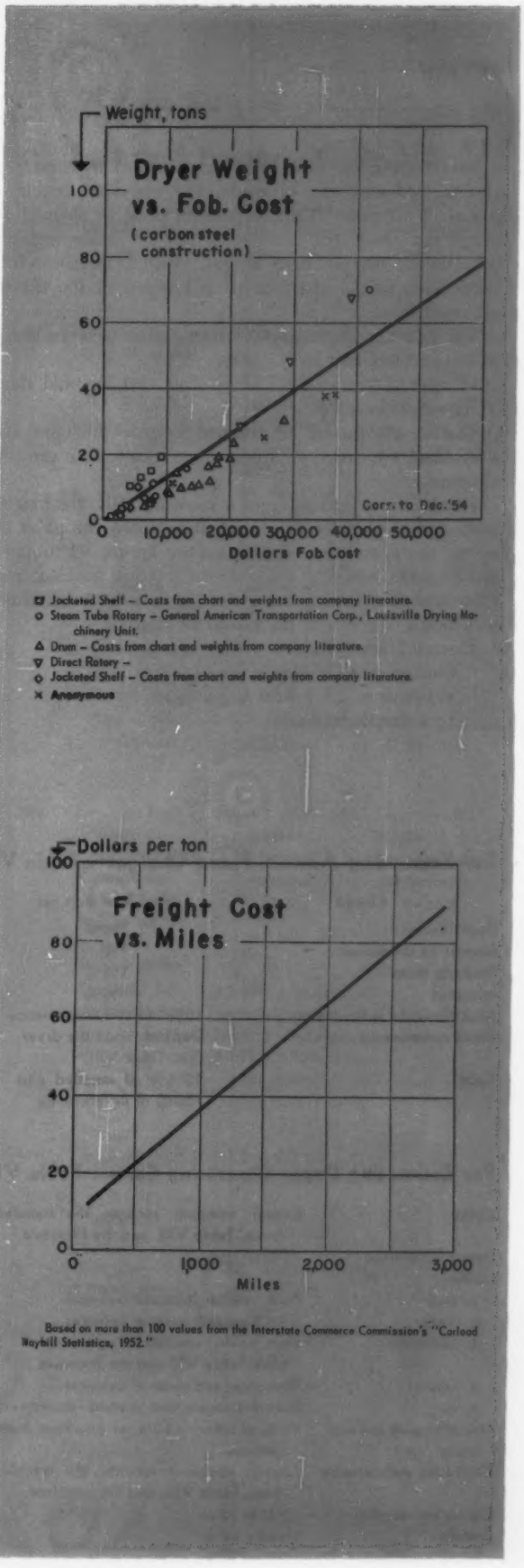
Insurance charges on the drying equipment during transportation and installation should amount to only a few tenths of 1% and will be considered negligible here although an approximation should be obtained from an agent for close estimates.

Freight Costs

The estimated freight charges should be obtained from a freight agent and should be based on the shipping weight of the dryer and auxiliaries whenever possible. However, a rough estimate can be made from the fob. cost for carbon steel construction of any dryer. The method and the reasoning behind it will be explained below.

The purchase price of a dryer is composed primarily of material costs and labor costs for the shaping of that material; and the fraction of the total fob. cost due to each varies with the type and size of the dryer.

For example, some types of dryer are more complicated than others and require a higher fraction of the total cost for shaping and installing the many components. For a particular type the material cost is approximately proportional to the size of the dryer while the labor required increases only slightly with size. Therefore, the fraction of the cost due to material decreases with complexity and increases with size, and an accurate correlation of material



cost versus total fob. cost should be a function of both dryer type and size.

Nevertheless, an approximate correlation, independent of type and size, can be made; and since the cost per pound of all mild steel components prior to shaping is about the same, the correlation can be made directly between fob. cost and dryer weight. Such a correlation has been made in the chart on p. 193 based on the dryers indicated there.

The equation expressing the relationship between dryer weight and fob. cost is:

Weight in tons = 0.00131 × (fob. cost for mild steel construction in dollars)

The weight should be assumed roughly the same for alloy steel construction unless more exact data can be obtained.

Even if the shipping weight is known exactly, the freight costs cannot be determined accurately unless the point of origin, route, and final destination are known. Estimates can be made, however, based on the distance traveled; and *Chemical Engineering* has given the following formulas[30] to which a 3% federal tax should be added:

Eastern United States

Carload rate (30,000 lb. min.):

¢/100 lb. = 25 + 0.06 × (miles)

Less-than-carload rate:

¢/100 lb. = 55 + 0.12 × (miles)

Transcontinental

Carload rate (30,000 lb. min.):

¢/100 lb. = −75 + 0.16 × (miles)

Less-than-carload rate:

¢/100 lb. = −80 + 0.26 × (miles)

A more general but somewhat less accurate equation for the estimation of freight rates has been empirically derived for use here. Data from the Interstate Commerce Commission's "Carload Waybill Statistics, 1952" have been plotted in the chart on p. 193. Revenue for tank shipments originating in Alabama, California, Delaware, Florida, Illinois, Indiana, Maryland, Massachusetts, Michigan, New Jersey, New York, Ohio, and Pennsylvania and for machinery shipments originating in Connecticut, Delaware, Illinois, Indiana, Massachusetts, New Jersey, New York, Ohio, Pennsylvania, and Wisconsin were used.

The revenue is roughly equal to \$9/ton + \$0.027/ton-mile.

A 15% Interstate Commerce Commission surcharge and a 3% federal transportation tax must be added to the railroad revenue to obtain the freight charges. Therefore, the freight can be expressed very roughly as \$10.6/ton + \$0.032/ton-mile.

This equation can be combined with that expressing the weight of a dryer as a function of cost [weight in tons = 0.00131 × (fob. cost for mild steel construction in dollars)] to correlate the freight charge with mileage and dryer cost:

(Freight in dollars) = (0.0139 + 0.0000418 × miles) × (fob. cost for mild steel construction in dollars)

This equation shows that freight is not a large item in the installed cost of a dryer, but neither is it completely negligible. It will vary roughly from less than 2% of the fob. price for local delivery to around 15% for a transcontinental haul.

These rates apply as of 1954. A freight agent should be consulted for percentage changes in rates in the future.

Space Costs

In a similar manner, the space occupied by the drying unit can be roughly correlated against fob. price. And such a correlation has been made in which the occupied volume in cubic feet, with a small allowance for working space, has been plotted against the fob. cost for several types of dryers. The data plotted indicate that:

The cost for the space occupied will vary from negligible for outside installation to over \$1 per cubic foot for some indoor installations. The actual value of the space occupied should be determined if possible, but for rough estimating purposes the value of \$0.80 per cubic foot has been used. The cost of the space occupied by the dryer for inside installation therefore is about 7% of the fob. cost.

Space occupied (cu. ft.) = 0.088 × (fob. cost for carbon steel construction).

Labor and Direct Material Costs

The labor of installation includes that required to connect utilities and process lines to the unit as well as that used in constructing foundations, moving and setting up the components, insulating the installation, fireproofing it where necessary, and pointing it.

For Estimating Annual Fixed Charges—Table VI

Charge	% of Installed Cost
Depreciation	7½%
Interest on investment	3%
Property taxes	1½%
Insurance	½%
Miscellaneous indirect costs	50% of fixed maintenance
Fixed maintenance	Depends upon the dryer (See Table VIII)
Total	12½% of installed cost + 150% of maintenance

For Estimating Dryer Operating Costs—Table VII

Labor	Consult company records, the manufacturers, Table VIII, and the literature.
Direct supervision	15% of labor.
Utilities	
a. fuel	From heat and material balances
b. water	From heat and material balances
c. electricity	From power required for operation (See Table VIII and the literature.)
d. steam	From heat and material balances.
e. air	From instrument and process requirements
Miscellaneous indirect costs	75% of labor +50% of operating maintenance.
Operating maintenance	Consult company records, the manufacturer, Table VIII, and the literature.
Operating supplies	10% of labor.
Royalties	Usually none.
Control laboratory	20% of labor.

Roundup of Dryer Data: Costs, Capacities, Fuel and Power—Table VIII

Dryer Type[1]	Operating Labor, Men	Annual Maintenance, % of Installed Cost	Installed Cost	Usual Capacity,[2] Lb. Water/Hr./Sq. Ft.	Heat Required, Lb. Steam/Lb. H_2O Evaporated	Total Horsepower
Class I, Continuous						
Drum	½	up to 10; $3 to $4/sq. ft./yr.[4]	2 × fob. cost[7]	1.5 — 8.0[4] U = 10 — 50[7]	1.3 — 2.5[4]	0.0067 (rpm. × sq. ft.)
Spray	½ — 1	$150/yr. for a small dryer;[4] $350/yr. for a large dryer[4]	[3]	0.1 — 3.0 lb. water/hr./cu. ft.[4]	2,100 — 1,600 Btu./lb. H_2O[8] evap. 2,000 — 5,000 Btu./lb. H_2O evap.[5]	0.018 × (lb. H_2O evap. / per hr.)
Class I, Batch						
Pan and Kettle	½ + 2 man-hr./batch	5 — 10	(2 — 3) × fob. cost[7]	1 — 3 (at high moisture) 0.1 — 0.5 (at low moisture) U = 5 — 35 (Pan) = 20 — 75 (Dopp kettle for liquids)	1.3 — 1.8 (at high moisture)[7]	(1-2) × (Dia.)
Jacketed Shelf		5 — 10 (with vacuum); $2 to $3/sq. ft./yr. (with vacuum)[4]		0.03 — 0.2 U = 1.0 (vacuum)	1.3 — 2.0 (at high moisture)	(0.007 — 0.15 hp.) sq. ft.
Vacuum Rotary	1/6 — 1, depending on cycle length and number of dryers	5 — 10	(1.5 — 3) × fob. cost	1 — 3 (at high moistures) 0.1 — 0.5 (at high moistures) U = 5 — 35 (clean walls) = 1 — 2 (caked walls)	1.3 — 1.8 (at high moisture) 5 (at low moisture)	approx. 0.2 (length × dia.) (dimension in ft.) not including vacuum equipment
Jacketed Vibrating Conveyor	up to ⅓			U should be slightly better than for screw conveyor dryer	40-60% efficient with hot air as heating medium; 60-90% efficient with steam.	
Class II, Continuous						
Screw, Paddle or Trough Conveyor	1/5 — ⅓	10 — 15	(2 — 3) × fob. cost	1 — 3 (at high moisture) 0.1 — 0.5 (at low moisture) U = 2 — 30	1.5 — 2.5 (at high moisture)	
Indirect Rotary	1/5 — ⅓	no more than 10	approx. 2 × fob. cost	U = 2 — 10 (at steam temps.)	40 — 65% efficient with hot air	0.5 — 1 × (Dia.^{2})
Steam Tube	1/5 — ⅓	no more than 10	[3]	U = 2 — 10	75 — 90% efficient	0.3 — 0.7 × (Dia.^{2})
Tunnel	Slightly less than that for tray dryer	up to 10			about 40% efficient	
Belt		$300/yr. for 240 sq. ft.;[4] $400 — 500/yr. for 560 sq. ft.[4]				
Screen Conveyor	1/6 — 1	2½ — 10			1.8 — 2.2	1 — 60[6]

Roundup of Dryer Data—Table VIII, continued

Dryer Type[1]	Operating Labor, Men	Annual Maintenance, % of Installed Cost	Installed Cost	Usual Capacity,[2] Lb. Water/Hr./Sq. Ft.	Heat Required, Lb. Steam/Lb. H_2O Evaporated	Total Horsepower
Turbo	less than 1/16	0.2 — 0.5	[3]	0.2 — 2.0 (0.7 — 0.8 for most materials)	1,500 — 4,000 Btu. per lb. H_2O evap.	[3]
Direct Rotary	1/5 — 1/3	5 — 10; $100 — 300/sq. ft. of peripheral area[4]	(1.5 — 2.5) × fob. cost; direct labor = 15% of fob. cost	0.2 — 10.0 0.2 lb. water/hr./cu. ft. (usually 1.5 — 3.0)	1,750 — 3,500 Btu. per lb. H_2O evap.	0.5 — 1 (Dia.[2])
Flash	1/5 or more	1 — 3¢/ton product (without disintegration); 2 — 5¢/ton product (with disintegration); 3 — 10¢/ton product (with pulverizing)	[3]		1,600 — 3,750 Btu. per lb. H_2O evap.	
Fluid Bed	about 1/6		2 × fob. cost; approx. 25% of fob. cost for labor and material for installation			
Louvre		2½	1.2 × fob. cost	(Roto-Louvre) approximately 50% greater than single-shell direct rotary of same size	1,700 — 4,400 Btu. per lb. H_2O evap.	hp. = (dia.)[3] (roto-louvre) hp. = (width)[3] (multi-louvre)
Direct-Indirect Rotary	1/5 — 1/3	5 — 10	(1.5 — 2.5) × fob. cost	approx. 35% greater than for direct rotary	75 — 85% efficient at high temperatures	0.5 — 1 (Dia.[2])
Class II, Batch						
Cone	1		$200 to $500			
Shelf, Tray, Cabinet, and Compartment	(1/5 — 1/3) + 4 man-hr. to load and unload 1,000 sq. ft.	3 — 5; $1 — $2/sq. ft.[4]		0.03 — 0.30 0.02 — 2.5 (through circulation)	20 — 50% efficient	
Truck	(1/5 — 1/3) + 4 man-hr. to load and unload 1,000 sq. ft.	3 — 5		0.03 — 0.30	20 — 50% efficient	1 hp./truck
Vapor	1/5 or less	not over 2	1.1 × fob. cost			
Class III, Continuous						
Cylinder				1.5 — 5.0 (use about 60% of total surface)	1.3 — 2.5	1 × no. of cylinders (4 — 6 ft. in dia.)
Infrared						
Dielectric				lb. water evap. per min. = 0.052 × kw. output	30 — 60% efficient	
Class III, Batch (All dryers previously discussed)						

Unassigned data from Ref. 1 or from private communication. (1) Dryer types: Class I = materials that can be pumped; Class II = materials that can't be pumped but can be stirred; Class III = materials that can't be pumped or stirred. (2) U = over-all heat transfer coefficient for conduction drying, Btu./(hr.) (F.) (sq. ft.). (3) Refer to cost curves for specific dryers. (4) Ref. 11; (5) Ref. 4; (6) Ref. 2; (7) Ref. 16; (8) Ref. 3.

This labor can vary from an almost negligible factor for small package units to at least 50% of the fob. cost for units requiring extensive construction work at the site. Therefore this item should be estimated for each case under consideration.

In like manner, the direct material costs for installation can vary over a wide range and should be estimated for each installation. If company records are not readily available from which estimates can be made of material and labor costs for the installation of utilities, process lines, foundations, insulation, and fireproofing and for painting and other miscellaneous jobs, the literature can be consulted for rough estimates.

For example, the material used in foundations should

Dryer Performance

Rotary Dryers—Table IX

	Direct, Parallel-Flow		Direct, Counter-Flow		Indirect	
Material dried	Shale, stone	Pebble phos.	Mang. ore	Stone	Chalk	Kaolin
Shell (dia. x length), ft	8.67 x 80	7.5 x 55	5 x 40	7.5 x 75	5 x 35	7.5 x 55
Moisture in feed, %	10.0	13.8	8.0	5.4	28.0	23.0
Moisture in product, %	1.0	1.3	0.9	0.1	0.1	2.0
Production rate, ton/hr	90	55	15	50	1.5	7.5
Type of fuel	oil	oil	oil	coal	oil	coal
Fuel/hr., lb. or gal	180	193	34	670	19.5	705
Btu./lb. water evap	1,500	1,810	2,220	1,550	2,340	2,400
Fuel per delivered ton of product, lb. or gal	2.0	3.5	2.26	13.4	13.0	94.1
Total power, hp	145	85	22	70	18	65
Unit operating costs, $						
per ton product	0.14	0.23	0.15	0.09	0.88	0.60
per ton water evap	1.36	1.56	1.88	1.49	2.30	2.18

Fuel at $0.40/million Btu.; power at $0.01/hph.; no other operating costs included. Maintenance labor and materials: for large dryers, $0.02 to $0.04 per ton product; for small dryers, $0.10 to $0.20 per ton product. All prices as of Sept. 1952—Hardinge Co.

Turbo Dryers—Table X

Material dried	Plastic resin	Molding powder	Salt	Starch	Aluminum hydrate	Silica hydrogel	Sewage sludge
Initial moisture content (wet basis), %	60	2	3.3	28.5	50	75	84
Final moisture content (wet basis), %	1.0	0.1	0.1	13	0.5	5	65
Dried product, lb./hr	1,000	400	13,000	7,900	1,000	100	21,000
Evaporation, lb./hr	1,500	8	429	1,660	1,000	280	25,000
Drying time, min	90	40	20	80	45	120	120
Inlet air temperature, F	50	50	50	50	50	50	950
Exit air temperature, F	240	250	300	190	280	300	250
Total air thruput, lb./hr	15,000	240	6,200	18,500	10,000	2,000	175,000
Air vel. over product, fpm	450	300	450	600	450	600	900
Method of heating	Steam	Steam	Steam	Steam	Steam	Steam	Flue gases from coal
Heat consumption, Btu./lb. dried product	2,540	50	92	330	1,600	4,720	1,830
Heat consumption, Btu./lb. water removed	1,700	2,500	2,800	1,590	1,600	1,700	1,540
Power consumption, dryer hp	1½	¼	1	2	1	⅓	5
Power consumption, fans hp	7½	⅓	5	15	5	¾	35
Materials of construction	Stainless steel	Stainless steel	Stainless steel & transite	Aluminum & transite	Aluminum & transite	Stainless steel	Steel & transite
Dryer size dia., ft	19	6	15	24	14	6	35
height, ft	19	6	22	33	17	11	60
Approximate price	$71,000	$9,400	$45,000	$94,000	$29,500	$20,000	$225,000

All prices as of Dec. 1948—Wyssmont Co.

Dryer Performance, continued

Direct-Indirect and Steam Tube Rotary Dryers—Table XI

	Direct-Indirect			Steam Tube	
Material dried	Silica sand	Zinc slimes	Anth. coal	Scrap rubber	Corn gluten
Shell (dia. x length), ft	5.83 x 35	5.83 x 35	7.5 x 55	4 x 30	6 x 30
Moisture in feed, %	5.0	43.0	17.5	38.0	50.0
Moisture in product, %	0.1	22.0	2.9	9.0	12.0
Production rate, ton/hr	15	5.5	17.8	0.5	0.67
Type of fuel	oil	oil	coal	steam	steam
Fuel/hr., lb. or gal	16	40.2	800	805	2,340
Btu./lb. water evap	1,500	1,520	1,360	1,600	2,050
Fuel per delivered ton of product, lb. or gal	1.06	7.31	45.6	1,610	3,480
Total power, hp	25	19	61	6	10
Unit operating costs, $					
per ton product	0.08	0.48	0.24	0.70	1.38
per ton water evap	1.52	1.32	1.26	1.56	1.84

Fuel at $0.40/million Btu.; power at $0.01 hph.; no other operating costs included. Maintenance labor and materials: for large dryers, $0.02 to $0.04 per ton product; for small dryers, $0.10 to $0.20 per ton product. All prices as of Sept. 1952—Hardinge Co.

Roto-Louvre Dryers—Table XII

Material dried	Ammonium sulphate	Foundry sand	Metallurgical coke
Dryer diameter	2 ft. 7 in.	6 ft. 4 in.	10 ft. 3 in.
Dryer length	10 ft.	24 ft.	30 ft.
Moisture in feed, percent wet basis	2.0	6.0	18.0
Moisture in product, percent wet basis	0.1	0.5	0.5
Production rate, lb./hr.	2,500	32,000	38,000
Evaporation Rate, lb./hr	50	2,130	8,110
Type of fuel	Steam	Gas	Oil
Fuel consumption	255 lb./hr.	4,630 cfh.	115 gph.
Calorific value of fuel	857 Btu./lb.	1,000 Btu./cf.	150,000 Btu./gal.
Efficiency, Btu. supplied per lb. evap.	4,370	2,170	2,135
Total power required, hp	4	41	78
Approximate cost of dryer & auxiliaries, f.o.b. factory	$12,500	$38,000	$63,000
Approximate erection and installation cost	$2,500	$7,500	$12,500
Dryer cost per ton of product*	$0.424	$0.388	$0.675

*Based on: production time, 7,200 hr./yr.; equipment write-off, 10 yr.; power, $0.02/kwh.; fuel $.25/1,000 lb. steam or $3.50/ton coal; labor, $1.75/hr.; maintenance, 2½% of equipment cost/yr. All prices as of Sept. 1952—Link-Belt Co.

Multi-Louvre Dryers—Table XIII

Material dried	Soybean meal	Bit. coal (⅜ x 0)
Width, ft	6 ft.	12 ft.
Chain centers, ft	14 ft.	24 ft., 2 in.
Moisture in feed, %, wet basis	18.0	7.0
Moisture in product, %, wet basis	10.7	2.0
Production rate, lb./hr.	14,110	275,550
Evaporation rate, lb./hr	1,255	14,770
Type of fuel	Steam	Coal
Fuel/hr., lb.	2,480	3,040
Efficiency—Btu. supplied per lb. evap.	1,715	2,410
Total power, hp	29.5	137.5
Drying cost per ton of product*	$0.408	$0.088

* Based on: production time, 7,200 hr./yr.; equipment write-off, 10 yr.; power, $0.02/kwh.; fuel, $.25/1,000 lb. steam or $3.50/ton coal; labor, $1.75/hr.; maintenance, 2½% of equipment cost/yr. All prices as of Sept. 1952—Link-Belt Co.

run 4 to 8% of the fob. cost of the equipment. The labor cost for foundations should be about 75 to 150% of the material cost. The cost of material for insulation, fireproofing, and painting should be 5 to 15% of the fob. cost. The labor required should be 120 to 150% of the material cost.[34]

Probably the simplest method of roughly estimating the direct materials and labor of installation is to estimate the materials required and use 150% of that value for labor. Alternatively, the labor can be estimated and the materials can be taken as 67% of the labor cost. In a few instances, some labor costs of installation have been given in the literature and these data have been included in Table VIII.

Indirect Construction Costs

The indirect construction expense includes such items as temporary construction, temporary roads and sidings, rental of equipment, field and home office overhead, engineering design and drafting, workmen's insurance, social security taxes, other payroll expenses, cleaning, testing of equipment, and many other indirect costs. These costs are roughly proportional to the direct labor costs and should lie between 40 and 60% of them.[34] A value of 50% of the labor of installation has been used in Table V.

Contingencies allow for errors and unpredictable expenses in the estimation of direct costs for materials and labor. About 10 to 15% of these costs is allowed for contingencies[34] and a value of 12½% has been used in Table V.

The contractor's fee can vary from nothing when a company installs a dryer itself to as much as 30%. Usually this fee does not exceed 15%[34] and that figure has been selected for Table V.

In summary, the installed cost of a dryer can be determined approximately from the relationships given in Table V when the fob. cost of the dryer and either the direct labor or the materials required to finish the installation are known.

Costs of Drying

As previously mentioned, drying costs can be divided into fixed costs and operating costs. The fixed costs are those which are relatively independent of the amount of material dried. They include insurance, taxes, depreciation, and interest charges for the investment in the drying installation. The operating costs are those directly related to the amount of material dried. They include labor and the utility charges for fuel, water, electricity, steam, and air.

In addition to these clear-cut fixed charges and operating charges, there are others—such as maintenance, plant protection, office overhead, control laboratory overhead, and administration—which can be handled either as fixed costs or as operating costs. Maintenance is the only one of these of great individual importance, and it actually can be divided into fixed and operating charges. However, maintenance usually is given either as a percentage of the installed cost or as a function of the throughput, and is not divided into two portions. Therefore, maintenance will be listed with both the fixed and the operating costs with the understanding that maintenance should be inserted in the costs only under one or the other, not both.

In like manner, the miscellaneous indirect costs will be listed under both fixed and operating costs with the understanding that those costs placed in one category should be excluded from the other.

Fixed Charges

The fixed charges have been outlined in Table VI. Although each of the items differs with company practice and location, some common generalizations can be made, and have been summarized.

Depreciation can be based upon the expected life of the equipment, upon the depreciation allowed for income tax purposes, or some other arbitrary scale. An average figure is 7½% per year of the installed cost. This value completely depreciates the dryer in less than 15 years and is convenient to use because it is a constant over that period.

The interest on the investment logically should be about 6% per year of the difference between the installed cost of the dryer and the funds accumulated to cover its depreciation. If straight-line depreciation is used, the average annual charge for interest on the investment during the life of the unit will be approximately 3% of the installed cost.

Property taxes should be calculated for individual cases. For example, the annual property tax in the Kansas City area can vary, depending upon location, from 0.6 to 3% of the actual value of the drying unit. A good figure for rough estimates would be about 3% of the depreciated value. With straight-line depreciation, the average property tax for the life of the equipment would be about 1½%.

Insurance costs likewise should be determined for each case under consideration. The rates for fire insurance and extended coverage can vary from well under 1% to more than 2% for especially hazardous locations without good fire protection. A satisfactory figure for general purposes is 1% of the depreciated value, or an average of ½% per year of the installed cost.

Miscellaneous indirect costs, such as plant protection and safety, office overhead, administrative overhead, engineering, cafeteria operation, purchasing department overhead, storeroom overhead, medical department operation, etc., and the indirect payroll expenses, such as vacations, social security, pensions, sick leave and other employee benefits, usually are apportioned according to labor costs. The amount of these miscellaneous costs usually ranges from 50 to 100% of the productive payroll.[28] Since the only labor associated with the fixed charges is that involved in maintenance, the indirect fixed costs can be expressed as a function of maintenance. Maintenance costs consist of about 50 to 65% labor.[29] Therefore, the fixed miscellaneous indirect costs vary roughly from 25 to 65% of the fixed maintenance costs; and a value of 50% of maintenance has been used in Table VI although the actual indirect costs should be obtained from company records if possible.

Operating Costs

Operating costs have been summarized in Table VII as labor, direct supervision, utilities, miscellaneous indirect costs, operating maintenance, operating supplies, royalties and control laboratory charges.

The labor cost can vary widely—from 20% to 100% of

one man's time—with about 50% of a man's time as a fair average for preliminary evaluations. Most continuous dryers practically run themselves when fully equipped with instruments, but batch dryers require at least one full man for loading and unloading and considerable attention in between. Labor requirements have been given for most of the dryers in Table VIII and fairly good estimates for the others can be made by considering similar types.

The charge for direct supervision should be made on the basis of actual plant figures, but a value of 15% of the labor costs can be used for rough estimates.

The utility costs, especially for fuel, usually are the most important of the operating expenses. Most can be calculated directly from heat and material balances about the dryer. The power for mechanical operations, however, must be determined from data and equations in the tables, text, and other references. The air required usually is limited to that taken by pneumatic control instruments and often can be neglected.

The miscellaneous indirect costs were discussed earlier and they have been assigned the value here of 75% of the direct labor plus 50% of operating maintenance.

Operating maintenance seldom is given in the literature. Instead, annual maintenance usually is presented as a percentage of the installed cost—2½ to perhaps 10%, depending on mechanical complexity and operating conditions—with 6% a fair average for preliminary evaluations. Operating maintenance has been included in Table VII to cover the few cases in which maintenance is quoted as a function of throughput. So far as we can determine, dryer maintenance never is split into operating and fixed charges for estimating purposes. It should be included under one or the other, but not under both.

Operating supplies such as gloves, flashlights, grease, wiping rags, log books, and instrument paper and ink should amount to about 10% of the direct labor.[19]

Royalties usually are not charged on drying systems; this item has been included merely to cover such a case if it should occur.

The control laboratory facilities probably will be used by the dryer operators and some charge must be made. If the tests to be run are known, a good estimate can be made; otherwise, a charge of 20% of the direct labor is suggested.[18]

The total drying cost is the sum of the fixed cost (Table VI) and the operating costs (Table VII) on either an annual or a per pound basis.

A good example of the use of the methods outlined here, as applied to a specific drying problem, can be found on page 875 of the third edition of the "*Chemical Engineers'* Handbook."

Industry Needs More Data

Table VIII has been included as an aid in the development of rough drying cost estimates. More exact data should be used, if time is available, for the application of theoretical methods from this article, the handbook and the general literature. Some of the blanks in Table VIII can be filled in approximately by reference to similar dryers, but the need for more data is apparent.

It is hoped that as manufacturers become aware that they can be relieved of making cost estimates for projects still in the preliminary stages of development, they will make available simplified methods of roughly estimating costs of their dryers. The users of such data, in turn, should realize that any "short-cut" method of estimating costs is bound to be somewhat inaccurate and that final decisions should be based on manufacturers' quotations.

Meanwhile, engineers in industry can add to the general fund of knowledge concerning dryer costs by publishing data gained through plant experience. No engineer can be thoroughly familiar with all types of dryers, but the bits of information provided by individuals can be fitted together to complete the picture of drying costs.

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ACKNOWLEDGEMENT

Both the discussion and the data presented here are the result of advice, suggestions and information from many individuals. Particularly, contributions from the following are acknowledged: W. R. Cantrell, Taco Corp.; C. W. Jobes, The Carey Salt Co.; G. R. Van Kampen, Red Ray Mfg. Co., Inc.; R. C. Haws, Western Precipitation Corp.; R. L. Biggs, J. W. Greer Co.; L. E. Najder, The Pfaudler Co.; D. K. English, Ralston Purina; G. Halldorsson, Edw. Renneburg & Sons Co.; Malcolm S. Adler, F. J. Stokes Machine Co.; V. A. Cheney, Link-Belt Co.; L. W. Follett, Davenport Machine and Foundry Co.; Stanley J. Green, Acme Coppersmithing and Machine Co.; A. R. Jenny and R. J. Aldrich, Combustion Engineering-Superheater, Inc., Raymond Pulverizer Div.; John F. Maguire, Luken Steel Co., Lukenweld Div.; R. J. Russell, Hardinge Co.; Clyde W. Spears, Traylor Engineering and Mfg. Co.; F. H. Stratman, General American Transportation Corp., Louisville Drying Machinery Unit; Arnold Weisselberg and Victor Wichum, Wyssmont Co.; A. W. Fritz; C. D. Smith, Monsanto Chemical Co.

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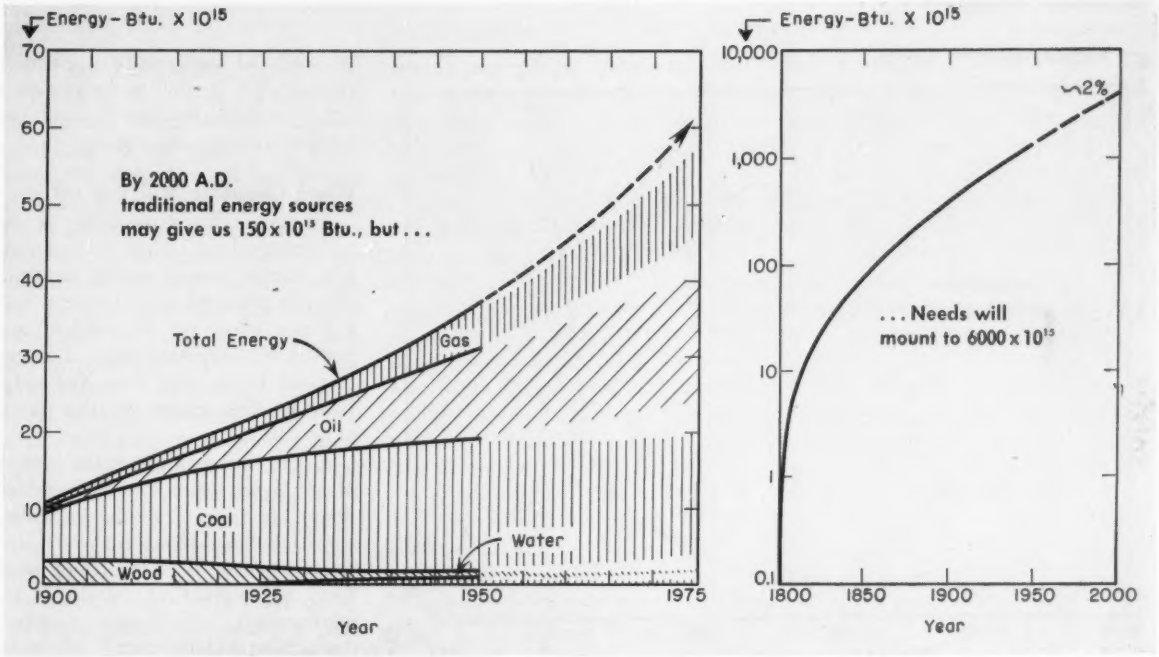


Tapping the Energy Sources

. . . A Wide Open Field for Chemical Engineers

MERRITT L. KASTENS, Stanford Research Institute

ENERGY sources that can be simply chopped down or dug up or pumped out—then burned—are going fast. Our rapidly mounting demand is beginning to put a strain on our finite supplies, and increasing exploitation costs are even now beginning to dictate a change in the traditional pattern of energy supplies.

New sources must be added to the conventional to cope with the growing energy demand of our industrialized society. And new technology—specifically, new chemical technology—will be required to exploit these energy sources of the future.

The question of how long we can maintain today's energy picture, and get by on today's fuels, has been a matter of some speculation among the experts. Although various authorities[1,2,3] differ markedly in their assumptions, in their techniques of analysis and, consequently, in their total figures, trend lines produced by their studies are essentially parallel. The trends, therefore, are much more significant than the exact numbers. The area of uncertainty lies simply in the timing.

Cost, Not Supply, Determines

It would seem that for the immediate future—in fact, probably for our lifetimes—there would be no need to seek alternate sources of energy—were it not for the critical factor of cost.

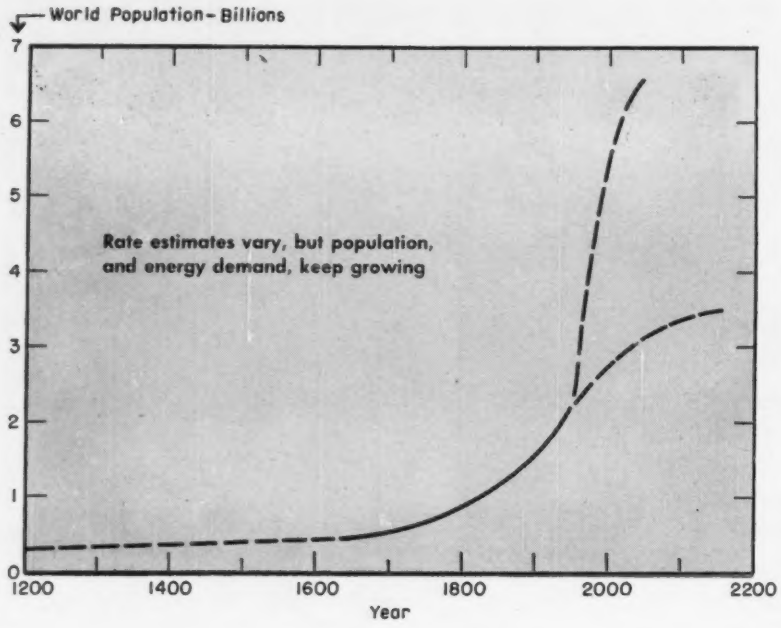
Over 90% of our energy requirements are now met by fossil fuels. While tremendous reserves of these resources exist, the most readily accessible have been used. Every ton, barrel and cubic foot secured now comes at a higher cost than the one before. The traditional expediences—finding new sources of fossil fuels, improving recovery processes and boosting burning efficiencies—are moving toward the point of diminishing returns both technically and economically.

Costs of discovering and producing crude oil are climbing steadily, even if the effects of inflation and rising labor costs are discounted. The same holds for solid fuels.

Implications are clear: We won't use up our entire reserve, perhaps not even a major part of the possible reserves, before shifting cost relationships make the use of other energy sources economically attractive. It also seems likely that the most economical future source will not necessarily be the conventional one or the one whose technology is simplest.

Demand Is Rocketing

While the economics of recovering the energy stored in fossil fuels grow less favorable, we're tacking an ever-higher per capita consumption onto a sharp increase in world population. A skyrocketing total energy demand is the result. Every indicator points to an expectation that between 1950 and the year 2000 the people of the world will use at least as many Btu.'s as they have since the year 1.



In this country the accelerating rate of growth of the per capita demand is now about 3.4% per year. Even assuming that this would fall off to about 2%, cumulative energy requirements from 1950 to 1975 would reach approximately 1.6 x 10^{18} Btu. Total cumulative demand between 1950 and 2000 would be about 4.3 x 10^{18} Btu.

Stacked against this are these estimates of our reserves of fossil fuels:

	Paley[2] 1 x 10^{18} Btu.	Putnam[3] 1 x 10^{18} Btu.
Coal	30	6
Gas and Oil	1.2*	0.5
Shale Oil	3	0.4
Total	34.2	6.9

* Termed uncertain

At the predicted[3] rate of consumption, this indicates that our fossil fuels will be essentially exhausted—so far as economic recovery is concerned—by the end of this century.

The timing may be wrong but the conclusion is still inevitable: We must have energy from additional resources some time within the next century, probably within the next 50 years.

Introducing a New Factor

The graph on p. 201 charts the pattern of U. S. energy consumption. It's obvious that our economy has become heavily committed to the liquid fuels between 1900 and 1950. Beyond 1950 the chart is a conscious and determined non-prediction.

It isn't a prediction because the direction of the curves beyond 1950 will be determined not so much by total energy demand, or by preference for fuel forms, or by population growth, or by all the other conventional economic factors, as by the accomplishments of chemical technology. The ultimate pattern will depend on how cheaply the chemist and chemical engineer can produce the various competitive forms of energy rather than on the absolute resource reserves.

This is a new factor in the energy equation. With minor exceptions, both the fuel and the power industries are virtually innocent of chemical technology.

But it now appears inevitable that the chemical technologist is about to find himself deeply involved in producing and converting energy. When we begin to consider possible "new" sources, we find that their exploitation will, in all cases, require heavy contributions from chemistry and chemical engineering.

Some of the possible sources, oil shales and tar sands, require a chemical alteration before they have any practical use as energy sources. If we persist in our preference for the conventional fluid fuels, the more plentiful solid fuels will have to be liquefied by chemical reactions in a chemical process. Not so obvious are the needs for chemical technology in exploiting nuclear and even solar energy.

Where Chemistry Will Pay Off

Obviously, there are nodes in the technological problems of exploiting new energy sources—points at which effective advances in technology have a major effect on the relative economics of competing fuels. I intend to point to some of these and judge their possible effects on the curves on p. 201.

A very thin segment at the bottom of the figure represents hydroelectric power. In spite of all the impressive dams and congressional oratory, hydroelectric power does not provide more than one percent of current U. S. requirements. And our country's topography dictates that it can probably only double or triple its present Btu. contribution at reasonable cost.[3]

Organic fuels, primarily wood, fill about 8% of our energy needs, but all common sense and engineering economics would lead us to expect that its contribution will continue to decrease.[3]

This assumption may not be valid if research currently in progress succeeds in developing rapidly growing trees or other forms of plant life for use as an organic fuel. Plant growth efficiency is something on the order of 0.2%.[4] Boosting this to 0.4% would mean that twice as much wood or fuel could be produced from a given area in a given time, and perhaps with little increase in cost.

Such a development could flatten out this particular curve and perhaps even induce it to rise somewhat.

Chemistry's Effect on Coal

It's in the area of the fossil fuels, however, that there is most room for speculation. The relative percentage contribution of coal to our energy supply has been dropping under the pressure of economics and factors of convenience. The curve up to 1950 has almost leveled off in terms of total Btu.'s.[3] The pressure of tremendous coal deposits viewed in contrast to increasing costs of recovering other fossil fuels from shrinking reserves will almost certainly affect coal consumption and point the curve upward.

The possibility exists, too, of a cost reduction in the recovery of coal from the ground, despite well-publicized predictions to the contrary.[2] The potentialities of mechanized coal mining are being more fully explored, and interestingly enough it is a chemical company that seems to have made the most important progress in this direction. Coal at one dollar a ton at the mine head has been mentioned as a realistic possibility.

Admittedly, mechanized mining would only be possible in fairly favorable geological situations, but nonetheless realization of these dreams would introduce considerable buoyancy into the coal-consumption curve.

Large-scale production of liquid fuels from coal could also profoundly influence the shape of the coal curve. Although simple carbonization and distillation of coal is certainly the most direct means of winning liquid products from coal, the process isn't generally conceded much promise now.

High-temperature coking requires special types of coal and wastes an impractical amount of potential chemical energy, simply by combustion to CO_2. Low-temperature carbonization is a will-o'-the-wisp which theoretical scientists and empirical inventors have followed for generations with equally meager success. Its moderate operating conditions, apparently small equipment requirements, and seemingly simple chemistry make it obviously attractive. However, even with highly volatile coals or semi-coals, yields are disappointingly small and so complex that the method probably holds more promise as a source of synthetic gas or chemical products than as a direct source of fluid fuel.

Eliminating the Mining Operation

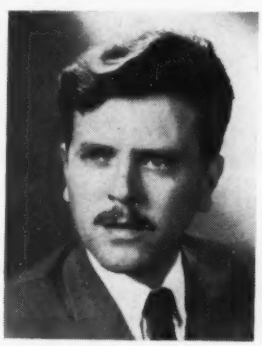
A more feasible possibility lies in eliminating the mining entirely through some process that will in effect fluidize the coal in the ground. Considerable effort has been directed at burning the coal in the seam to produce what amounts to a "water gas" for fuel purposes. Such underground gasification could incidentally extend coal reserves by making practical the exploitation of seams too narrow or too broken to be suitable for more conventional mining techniques.[5,6]

In underground gasification, air, oxygen, enriched air, steam, or a mixture of these is pumped into a coal bed prepared by tunneling, electrolinking, physical fracture or some other method.

The problem is to provide enough burning to break down the coal complex and still have a gas left with sufficient Btu. content to warrant handling. Its solution depends, among other things, on reducing gas leakage through the overburden, developing a gas-tight seal at the gas outlets and improving firing techniques to prevent cave-ins and consequent obstruction of the gas flow. Most important, the combustion must be controlled and flows of the input and output gases regulated.

Combustion is a chemical reaction and the induction and control of chemical reactions is the professional precinct of the chemical engineer. Bureau of Mines field experiments have succeeded in bringing 75 to 90% of the energy in the coal to the surface in usable form.

They've made fair quantities of low-heat-content gas (about 100 Btu./cu. ft and some as high as 500-700 Btu./cu. ft.). This is sufficient to be at least technically attractive. If the Btu. content could be increased consistently, the process would be also economically attractive.[4]



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Making Synthetic Liquid Fuels

Alternative to this procedure, the coal could be mined, then liquefied in a plant at the surface. Two general means accomplish this end. The Fischer-Tropsch process—or so-called gas synthesis process—is very well worked out in principle; the chemistry is "all done." In this process, powdered coal is gasified with oxygen and steam to produce a gas consisting of CO and H_2 that can be reacted to form liquid hydrocarbons.

The techno-economic problem lies in the cost and efficiency of the coal gasification step. This accounts for about 70% of the total cost of gasoline produced by this method, and 80% of the total cost of high-Btu. gas. Natural gas may be substituted for coal in the process, but in view of declining gas reserves there's no long-range economic incentive for doing so.[6,7]

Basically, there's a chemical fallacy in this scheme: A very complex organic structure must be dug up, much money and effort must be spent to break it down to the smallest possible fragments and then added effort must be spent putting the fragments back into a moderately complex configuration. It would certainly seem much more attractive to reduce the coal complex into relatively simple organic molecules directly, without going around the barn.

This is the approach of coal hydrogenation.[8,8,9] One of the major drawbacks is the tremendous capital costs of the plant—on the order of $500 million for a capacity comparable to that of a large petroleum refinery. Under present methods coal hydrogenation is a catalytic reaction, but compared to industrial catalytic processes, catalyst performance is very poor. This makes high pressures and high temperatures necessary for the reaction to proceed within a reasonable residence time.

One operating coal hydrogenation plant, producing aromatic chemicals, uses pressures ranging between 3,000 and 6,000 psig. and temperatures from 840 to 1,020° F. An experimental plant that breaks the coal polymer into the smaller fragments that make good gasoline operates under the more strenuous conditions of 10,300 psig., with temperatures between 800

NUCLEAR REACTORS, as modeled here, breed challenges to chemical technology—and opportunities for chemical engineers.

and 900° F. The chemical operation requires 4½ min. of contact with 0.5% by weight of catalyst. Liquid-phase conversion in the gasoline operation takes one hour and 4% catalyst.

Obviously, if the catalytic efficiency of the gasoline production operation could approach that of the chemical operation, or even be doubled, cuts could be made in the contact time, or the pressure, or the temperature. In any case, effects on process economics would be major—sufficient perhaps to shorten to a few years the time needed to make this process competitive as a source of liquid fuels.

The impact of cheaper coal, and its economic conversion into liquid fuel, on the extrapolation of the curve of coal consumption is apparent. If technical bottlenecks can be broken, the curve will probably ascend rapidly. If they aren't mastered, or not mastered in time, other energy sources will continue to supplant coal in a growing list of uses.

Oil and Gas Outlook Straightforward

Outlook for oil and gas is fairly straightforward. Technological improvements in exploration and production, together with increasing efficiency in use, can keep the petroleum curve on its sharp ascent. However, in the absence of these developments, cost per energy unit for petroleum will rise steeply, and simple market economics will force a flattening of this curve.

The natural gas curve will in some measure follow the petroleum curve because of the general relationships between the availability of these two materials in the ground. Within the last few years we've reached the point of being able to use almost all of the natural gas found in conjunction with crude oil. Since gas is a highly preferred fuel with negligible processing costs, its consumption will probably be more dependent upon the supply available than the other fuel sources.

New Sources Hold the Key

Actually, the greatest influence on the future shape of the consumption curves will probably come from sources which are not yet represented on the graph.

It is generally assumed that the first new source of energy which will be tapped rests in the non-fluid, petroleum-like deposits found in the oil shales of Colorado, Utah and Wyoming. Conservative estimates indicate recoverable reserves of more than 80 billion barrels of crude shale oil from shale yielding an average of 30 gal./ton. However, since these cannot be used in their native form, their exploitation must await the contributions of the chemical technologists.

Owing to the excellent work of the Bureau of Mines, there isn't much chance of lowering the cost of mining oil shale. Any foreseeable reduction in the mining cost of 30¢/ton (or one cent per gallon of hydrocarbon material) would have little effect on the cost of the finished product. The payoff will come, rather, with the solution to three difficult problems.[10,11]

When kerogen—the organic matter in shale oil—is pyrolized, oil, gas and a carbonaceous residue form, and it's essential that the gas and/or residue (and not the oil) supply the energy, or fuel, to the system. The pyrolysis

retort must be designed for high throughput, in units of large individual capacity and, because shale deposits lie in semi-arid regions, to use little or no water when operating. Again the design and operation of such retorts present probems in heat transfer, mass transfer, controlled chemical reactions—all falling within the basic technology of chemical engineering.

It has been stated that, with present technology, oil from shale can be competitive with crude oil with a 25% increase in the cost of the latter. Obviously, if chemical engineers can extend our knowledge so that the cost of oil from shale drops steadily, we shall have fluid fuels from shale long before crude oil prices rise to this extent. If such a fuel takes its cut out of the energy distribution pattern, it may have a profound effect on the demand for the fuels now in use.[11]

Tar Sands Need Study

The tar sands, found primarily as surface outcroppings in Western Canada, require considerable further investigation before their technical and economic promise as a source of liquid fuels can be evaluated. Their hydrogen content may be too low to produce high-grade fuels without hydrogenation or without wasting a portion of the carbon content. In such a case chemical technology will be called upon to design the hydrogenation process.

However, even if the bitumens recovered can be processed by modifications of existing petroleum processes at costs not much different from those for processing heavy crude, past pilot-scale operations clearly indicate that the key to economic exploitation lies in devising a technique for coalescing the droplets of heavy oil after they have been separated from the sand. This is a straightforward, if not simple, unit operation.

Nucleonics Holds Chemical Problems

An almost inevitable energy source in the immediate future is nuclear energy. Current time estimates for its practical introduction are on the order of 10 to 20 years in the future, with costs of 4 to 8 mills per kilowatt hour.[13]

Technological challenges of nuclear energy are varied and have been well publicized. The chemical processing cycle to which the spent fuel elements must be subjected because of the buildup of fission product poisons and reduced content of fissionable nuclei, as well as the physical deterioration due to radiation damage, has, however, been relatively ignored.

Lawrence Hafsted, former head of the AEC's Reactor Development Program, has stated publicly on several occasions that the cost of chemically processing the spent fuel, particularly in a breeder-type reactor, will probably represent about half the capital and operating costs. He also feels that as a source of heat energy alone, atomic fission is unlikely to be commercially successful in the foreseeable future without assurance of additional revenue from the sale of atomic by-product materials.[18]

In the face of such an opinion from a most authoritative source, it is surprising that little effort has been expended by industry to analyze this process step either technically or economically. The AEC has devoted some classified study to this subject but not on a scale approaching the effort expended on reactor design. There are no comprehensive public figures as to the possible economics of this operation and, reportedly, almost nothing in the classified literature.[14,15]

This situation may exist because industrial study groups concerned with reactor development have been largely dominated by electric power people who have no experience and little interest in chemical problems. It would seem that if this job is to be done, it must be done by the chemical technologists and perhaps by the chemical industry.

In all likelihood, when nuclear power becomes a reality, power generated from the pile will be distributed by an experienced utility that will contract with an adjacent chemical company to process and rejuvenate the spent nuclear fuel. The chemical company would derive income not only from the service charge paid by the power company, but also from the sale of the chemically processed fission by-products.

Has Inherent Limitations

Granting the inevitability of the introduction of nuclear power, it must be admitted that this energy source has inherent limitations, and it's doubtful that nuclear power will assume more than a minor part of our energy load during this century. With present and foreseeable technology it is applicable only to installations with a large output and a relatively extensive plant site.

Nuclear energy, too, like the fossil energy sources, depends on a non-renewable resource. Because of its very recent importance, current estimates of the reserve of fissionable materials are probably quite low (20 to 25 times world reserves of fossil fuels).[8] However, it can be said with certainty that these reserves are finite and are subject to the economic law of increasing cost of recovery as their exploitation continues.

Later technical developments which may make possible direct conversion of nuclear energy to electrical power without the intervention of a "heat" form may increase the utilization efficiency of these resources and lengthen their life span. Controlled exploitation of nuclear energy from fusion reactions could introduce a whole new family of fuel materials, perhaps of nearly limitless abundance. Neither of these possibilities might change the economics of energy production drastically by making energy available at costs now considered impossibly low.

In such an event the consumption curves would change direction dramatically—providing an extreme demonstration of the fact that the source of energy supply depends not on the availability of reserves but ultimately on the state of technological development as reflected in operating costs.

Renewable Sources Offer Answer

In the absence of such developments, we must look to non-exhaustible sources of energy for a permanent solution to the energy problem. There is the possibility mentioned earlier for greater efficiency in the production of plant-type fuels. Energy recovered from the wind and the tides is also possible, but it can never supply more than a few percent of our total energy requirements and only in a few geographical locations.

Recovery of sensible heat from the sea and from the depths of the earth certainly offers great potentialities.

French scientists on the West Coast of Africa are experimentally tapping the source of power lying in the temperature difference between surface water and deep water.[16] However, even if these experiments are economically successful they will yield a technique useable at only a few favored locations.

Solar Energy for the Long Pull

The one non-exhaustible source which offers large quantities of energy in a generally accessible form is solar radiation. It isn't subject to depletion, much less exhaustion. In the very long term, solar radiation may well be the direct source of almost all our energy supply.

Two problems in the exploitation of solar energy properly fall to the chemical engineer. The first is the old, familiar problem of energy storage. This question is of interest with all energy sources, but it's basic to the use of solar energy because of the intermittency of the supply.

Present technology stores energy by such woefully inefficient mechanical means as pumping water, the storage battery—which is expensive, bulky, and of low efficiency—and through chemical synthesis, which is not now attractive for large-scale uses. We need either a new kind of box to store kilowatt hours or some way of storing heat as heat.

So-called chemical storage systems using the heat of fusion of melted salts have been developed—and in fact have made possible the solar heating of a house in Massachusetts that can maintain its temperature through nine days of cloudy weather. These systems, however, are only 13 or 14 times more efficient than water as a heat storage medium in the same temperature range and they represent an appreciable material cost.

By improving the heat capacity per unit volume of any heat storage system the chemical engineer could influence the economics of solar space heating and cooling in many areas of the United States. By providing an improved chemical or atomic device for storing electron displacement he could not only minimize the disadvantages associated with the intermittency of solar energy, but might supplant the storage battery with an economical means for increasing the load factor on more conventional energy conversion installations.

Chemistry as an Energy Consumer

Another possible mode of applying solar energy of direct interest to chemical technologists is the conversion of radiation energy into chemical energy. In theory, this conversion holds tremendous portent for the chemical professions and the chemical industry.

It has been known for some time that certain chemical systems will decompose water in the presence of sunlight, without consuming any other raw material. If this phenomenon can be harnessed, it could provide an infinite source of a perfect fuel in the form of hydrogen and oxygen. Use of such a fuel combination in recently announced fuel cells offer particularly attractive possibilities.

Other photosynthesis reactions suggest possible techniques to produce industrial chemicals. We know, for instance, that thousands of tons of ozone are produced by photosynthesis in the atmosphere of Los Angeles on a smoggy day. The reaction by which this material is formed is not yet fully understood, but the reactants are probably relatively simple and the requisite conditions certainly not extreme. Research teams are exploring the possibilities of photosynthesis for the production of organic compounds of interest as potential chemotherapeutic agents. Others have discovered interesting and unique effects of solar radiation on such reactions as polymerization.

Such use of the sun to induce chemical reactions will probably never be significant in the total energy picture. However, the chemical process industries are consumers as well as producers of energy and so have a particular interest in this specific development. Energy is introduced into industrial chemical processes primarily in the form of heat. In recent years, increased attention has been directed toward the possibility of providing such energy directly by electric discharge and even with mechanical vibrations. The sun may offer still another unexploited form by which energy may be introduced into chemical processes.

The comments above are admittedly brief. They are intended merely to "list by title" some of the salient problems which the economic history of our era is thrusting before the chemist and chemical engineer. These are not questions asked by fools to confound the wise. They are the questions that are being asked by the men who have looked at the increasing curve of energy demand and have been neither fool enough to ignore it, nor frightened enough to descend to a dire prediction of Malthusian doom.

They are questions that can be answered, and must be answered, and will be answered by a maturing technology to support an expanding technological culture.

Acknowledgments

Valuable assistance in preparing this paper has been provided by many members of the staff of Stanford Research Institute. Particular credit is due to Edward J. Burda; Nevin K. Hiester; Rudolph J. Marcus; Marmion S. Oldacre and William E. Rand, formerly with this organization and now with The Newhall Land and Farming Co.

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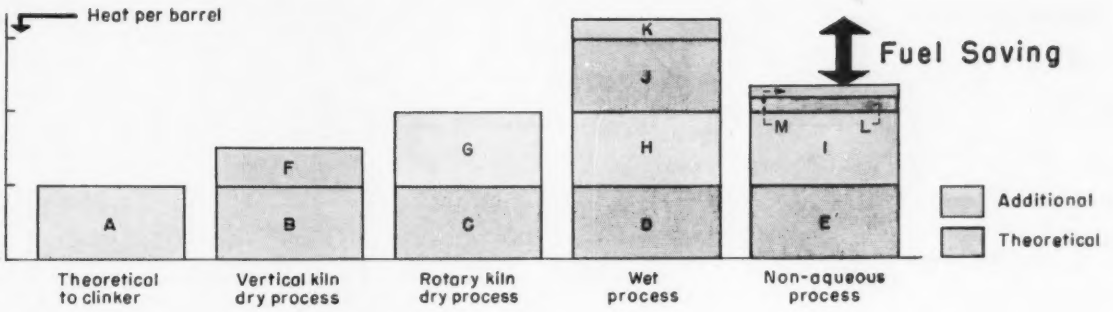

Non-Aqueous Cement Process

Editorial Staff Report

In the last 90 years since the development of the rotary cement kiln, almost every important improvement in kiln design and operation in the portland cement industry has been motivated by the desire for improved heat economy. However, in recent years it has become clear that the possibilities for further improvement are limited by inherent difficulties and that only some fundamental process change offers hope for much additional improvement. The new process described here is such a change. Although not yet developed to full plant scale, it suggests that operating cost savings of several cents per barrel of cement can reasonably be expected, in comparison with the conventional wet process.

Portland cement is made by grinding together a mixture of mineral raw materials, which is then burned in a kiln to produce a clinker. For any given raw material mixture and clinker, the theoretical quantity of heat required is a constant, regardless of the method of burning. However, all actual processes require additional amounts of heat, over and above the theoretical. It is toward the reduction of this additional heat that most efforts toward improving cement processes are aimed.

When portland cement was first patented in 1824 the only available kiln was the vertical type. Theoretically its additional heat requirement is small although it was actually large in the early stages of the process. As the industry's experience increased there was a gradual improvement in technique and the additional heat needs were lowered.

Above is a plot—roughly to scale—showing the heat requirements of various processes. It will be evident that the theoretical heat for all is the same, since the chart is based on the assumption of constant raw material and clinker composition. The heights of rectangles *A, B, C, D* and *E* represent the theoretical heats, and are each about 500,000 Btu. for a 376-lb. barrel of clinker. Note that the additional heat *F* for a vertical kiln is considerably less than that for any rotary kiln, *G, H* or *I*.

About 90 years ago the dry-process rotary kiln was invented, along with the technique of burning pulverized coal. This brought about a vast improvement in cement manufacture, including continuous operation, labor reduction, and elimination of rejected clinker, but it did require a much greater amount of additional heat. With gradual improvement, this was reduced, but even today there are kilns in operation in which the additional heat approximates the theoretical, give or take a few hundred Btu. Rectangle *G* represents this additional heat for the dry process.

The high heat requirements of the dry-process kiln had the paradoxical advantage of forcing many important advances in kiln and accessory equipment design and operation. Among these were increase in kiln size, kiln insulation, preheating of kiln feed and combustion air, and recovery of waste and radiated heat. Desire for fuel conservation was at least in part responsible for other improvements such as finer grinding and improved uniformity of raw mix, and finer coal pulverizing.

During the past few decades, most cement plants built in the United States have employed wet, rather than dry, grinding of the raw mix. The main advantage has been improved uniformity in the kiln feed. Against this is the disadvantage of still greater heat requirements. Where a dry-process kiln receives some 600 lb. solids for the production of 1 bbl. of clinker, the wet process introduces also about 400 lb. of water, or a total of 1,000 lb. of material to produce 376 lb. of clinker. Apart from the heat to vaporize the water, the additional heat for a wet process kiln (*H*, above) is the same as for a dry-process kiln. The theoretical heat to vaporize the water and superheat it to exit gas temperature (Area *J*) is about 500,000 Btu./bbl. so that the total heat required is roughly three times the theoretical, as compared with twice for the dry process. Actually, since the vaporizing operation is not perfect, some further additional heat, as represented by *K*, is also required.

Among the means used to improve fuel economy, waste heat boilers have tended to become less popular in the

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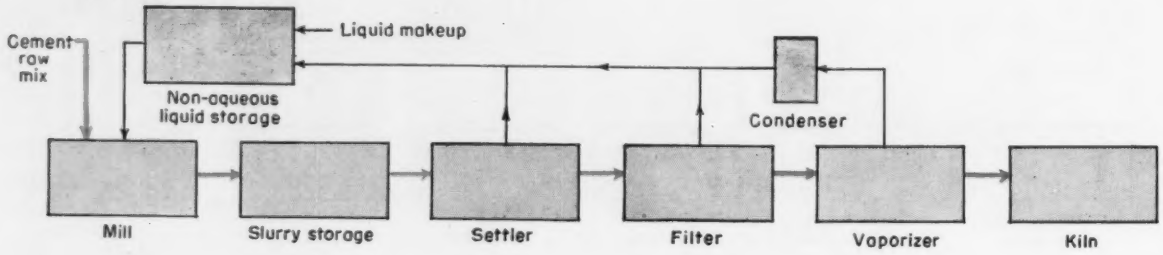
THIS REPORT *is based on a paper presented at the ASME's semi-annual meeting in Boston on June 21, 1955. Author of the original paper was J. C. Witt, consulting engineer of Chicago, who has spent many years in the cement industry and is the author of "Portland Cement Technology," a recognized text in the field.*



United States in wet process plants. In the dry process all the power for operation can be generated in waste heat boilers. However, water evaporation in the wet process cuts the waste heat available and standby electric energy or auxiliary prime movers must usually be provided.

Another method of bettering heat economy in the wet process is to eliminate as much water as possible from the raw mix. About 1925 the first filters were installed for partial dewatering of the slurry. Initially there was a rapid increase in filter use, but various operating difficulties appeared, and filters are not now generally used in wet-process plants.

This leaves Areas *G*, *H* and *I* on the chart as the most likely points for heat savings, and almost every possible lead has been investigated. Many of these investigations resulted in important technical developments. In general these improvements have been of two types, direct and indirect. In the direct, heat input is reduced by such methods as finer grinding of feed and coal, or improvements in kiln design, kiln insulation, or instrumentation. In the indirect improvements, gross heat input is not reduced but waste heat is recovered, with a decrease in net heat. Some of the factors affecting additional heat *K* are similar to those affecting *G*, *H* and *I*.

Non-Aqueous Process

The dry process has the advantage of low heat input. However, better uniformity of feed composition—with some decrease in raw material and fuel cost—is the advantage of the wet process. After many years of research along lines such as those indicated, Witt started investigating ways to combine the advantages of wet and dry processes. As long as he retained the idea of water as the grinding liquid, the research was not fruitful. However, in making a critical study of the role of water in the process, he found that it was not the water as such, but the presence of a mobile liquid, which gave the advantage to the wet process. The liquid facilitates grinding, blending, pumping and storage. At the same time, all the disadvantages of the wet process can be traced to one or more of the liquid's properties.

This understanding enabled him to set up the specifications for an ideal liquid which would: (1) remain liquid over a long range of temperature; (2) not react with the raw mix, even at high temperature; (3) be neither oxidized nor reduced; (4) not be deliquescent; (5) have a boiling point in the range of 300 to 600 F.; (6) have a low latent heat of vaporization; and finally, (7) be of reasonable cost and availability.

The properties of most non-aqueous liquids immediately ruled them out, but he found a group of petroleum distillates which meet the specifications satisfactorily. The liquid most used so far is No. 1 fuel oil (ASTM designation D 396-48T, in ASTM Standards, 1949, p. 891-3). The new process is covered in U.S. Pat. 2,611,714 (Sept. 1952) and a second plant application has been filed.

The new process has been studied by a number of organizations including the laboratories of the Sinclair Refining Co. It differs very little from the ordinary wet process—except in the nature of the liquid and in the practically complete recovery of liquid before the raw mix is clinkered. Raw materials, proportions of solids to liquid, and grinding equipment, are all the same.

The resulting non-aqueous slurry has several important advantages over the aqueous. It cannot freeze, it does not require constant stirring, it is unaffected by addition of recovered dusts from the dust collection equipment.

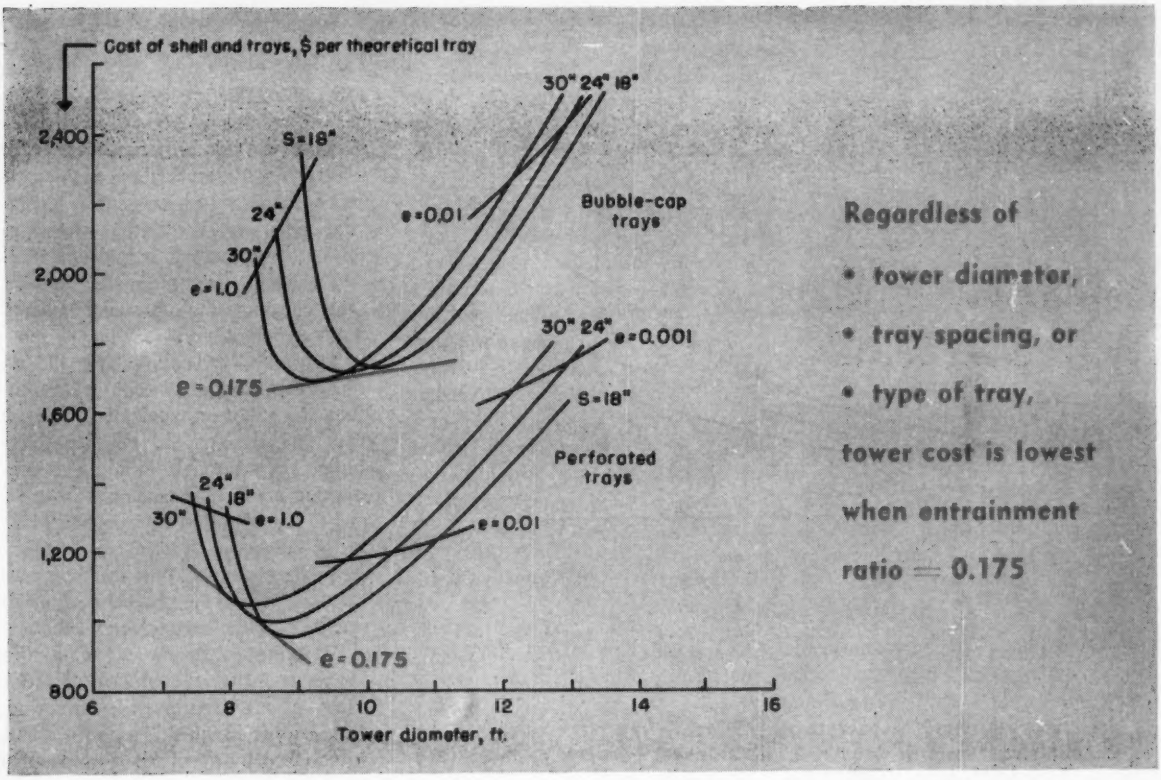
One important advantage is that the liquid is more readily separated from the solids. In a typical case it is believed that settling would separate one-fourth, filtration one-half, thus leaving only one-fourth for recovery by vaporization and condensation.

One possible hook-up (see the flowsheet) would use a simple vaporizer heated by waste heat, plus an air-cooled condenser, to recover the remaining liquid down to a few tenths of a percent, at the same time preheating the kiln feed and decreasing the kiln fuel needs. Kiln capacity would be materially increased.

Where the feed preparation is similar to that of the wet process—but with improvements—the clinkering is similar to the dry process. Heat requirement Areas *J* and *K* of the wet process are eliminated and for them are substituted the much smaller requirements *L* and *M*, where *L* is the theoretical heat for vaporizing the liquid—about a fifth of *J*. This means a saving of some 400,000 Btu./bbl. The additional heat for vaporization, *M*, is not yet determined, but is expected to be small. It is also anticipated that the use of waste-heat boilers will again become practical with the proposed process.

One interesting feature of the non-aqueous process is its applicability to clinker grinding also. Dr. Witt plans another paper to explain this.

Water, being cheap and readily available, is usually considered first as a processing liquid. However, it has often been found that another liquid would be more advantageous. Here is another case where quite possibly this will be found to be true.



Help in Picking the Right Tray

Here are cost and performance data—mostly previously unpublished—to help you compare and evaluate five different types of trays for distillation or absorption towers.

RAPHAEL KATZEN, Consulting Chemical Engineer

Recent activity in the field of tray design for distillation and absorption towers gives evidence of a healthy trend—tray design is being simplified.

In the field of bubble-cap tray design, chemical engineers for years have apparently been trying to see how complicated a gadget they could devise to accomplish an essentially simple contact. Advertising literature indicates that some vendors offer several hundred types and sizes of caps.

In the past few years, however, developments in tray design have tended toward simplification—fewer parts, fewer fabricating steps, less metal used. The simpler designs have in most cases achieved performance improvements.

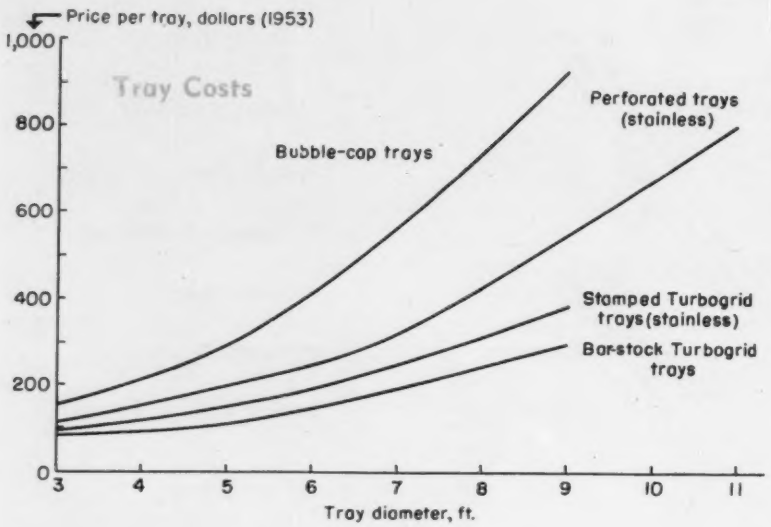
Despite special trade names, most tower trays perform essentially the same function and are closely related.

Thus, the bubble-cap tray, when straightened out so that the slots are in a straight line, becomes a Uniflux tray. Then when the slots are straightened out and made into an annulus, we have the Flexitray. Flattening the annulus into a rectangular slot, we get the Turbogrid. Then converting the rectangular slot into a circular one, we reach the perforated tray.

Perhaps further simplification of the sequence can be achieved. We can best direct our attention to further improvement by examining in more detail the design, operating improvements and economies achieved by these recent tray developments.

Bubble-Cap Trays

For decades the standard for tower design in the chemical and petroleum industries, bubble-cap trays have come to be regarded as the criterion against which all other types of trays are measured. Unfortunately, although in recent years most bubble-cap trays have been well designed, very many in active use have been crudely extrapolated from smaller-scale installations.



The resulting low efficiencies and high pressure drops obtained are often taken unfairly as a standard measure.

New types of trays (or packings) are almost always compared with "a well designed bubble-cap tray," but very seldom are data given for the exact loadings, pressure drops, efficiencies, etc. As an example of how far apart "well designed" bubble-caps can be, see the plot (opposite page) of test data for two 3-in.-dia. caps. One is a well balanced cap and riser design giving good contact efficiencies and moderate pressure drop. The other is an intricate, fluted design intended to yield better contact of liquid and vapor. It succeeds essentially in increasing pressure drop.

Despite considerable criticism leveled against them, bubble-cap trays are still widely used and specified where wide-range operating characteristics are desired.

As has been known since the definitive interpretation of Souders and Brown,[7] loading of bubble-cap trays is limited by increasing entrainment, which eventually decreases contact efficiency. The same criterion, however, can be applied to other types of trays, with some variation in the constants employed. On this basis of design, bubble-caps show an inherent deficiency as compared, for instance, with perforated or Turbogrid trays, because the caps themselves act as barriers, increasing hydraulic gradient and leaving less disengaging space.

Colburn[4] has defined the entrainment relationship as follows:

$$E_a = \frac{E_o}{1 + \frac{eE_o}{L/V}} \qquad (1)$$

where E_a = tray efficiency at entrainment ratio of e; E_o = tray efficiency at zero entrainment; e = entrainment ratio, lb. liquid/lb. vapor; L = liquid downflow rate, lb./hr.; V = vapor upflow rate, lb./hr.

From an economic standpoint, Zenz has found that permissible maximum entrainment for minimum tower cost is a function of liquid and vapor rates:

$$e_m = 0.175L/V \qquad (2)$$

where e_m = maximum permissible entrainment. Actual number of trays is

$$N_a = N_t[(1/E_o) + 0.175] \qquad (3)$$

where N_t = theoretical number of trays required.

Typical cost data for bubble-cap and perforated trays at various tray spacings s are plotted against tower diameter as shown on the preceding page. This plot demonstrates how Zenz arrived at the 0.175 entrainment factor for minimum tower cost. The curves also show clearly that the very much lower order of magnitude of entrainment for perforated trays as against bubble-cap trays yields lower costs.

Cost calculations were based on $12 per sq. ft. of bubble-cap tray area and $0.40-0.50 per lb., depending on the diameter, for shell cost. Tray costs for perforated trays were adjusted to coincide with perforated tray installations.

Uniflux Trays

Uniflux trays,[8] developed and licensed by Socony Mobil Oil Co., have been used primarily in petroleum refinery service, and data available pertain essentially to hydrocarbon separation operations. With 100 towers containing these trays in actual operation and 150 more being designed or constructed, operating experience is being accumulated rapidly.

This tray (see cut) retains the essential features of the bubble-cap in that it contains the elements of the riser and the serrated edge for bubbling vapors through liquid. The bubble slots are in a straight row, however, and so installed that vapor action helps move the liquid over successive channels. It is claimed that this compensates for hydraulic gradient, and all slots are under same submergence.

An important feature of the tray lies in the fact that the functional vapor cap is also a structural member. Successive units are quickly assembled and interlocked by means of slotted entry points.

With 12-14% slot area on the tray, and riser area two to four times as great as is usually available with conventional bubble caps, heavy loadings are possible with only moderate pressure drop. There is a question as to whether such large slot areas would yield efficient operation at low loadings. At 60-80% of design loading, an atmospheric crude distillation tower shows fairly sharp fractionation, but efficiency is expected to increase appreciably nearer design loading.

A 3-ft.-dia. debutanizer operating at one-third of design loading yielded 48% tray efficiency, which is low for this type of service. On the other hand, a deisobutanizer loaded to 90% of design at the top and 36% at the bottom showed an average tray efficiency of 96.5%.

Here are cost data for Uniflux trays of 6 to 12 ft. diameter, expressed in terms of sq. ft. of area:

16-gage, 12 chrome alloy:	$6-7
10-gage, carbon steel:	$5-6
16-gage, Type 316 alloy:	$8-9

All of the above costs include $1 per sq. ft. royalty.

Tower diameters considered would be the same for Uniflux trays as for conventional bubble cap trays. For a given diameter, it is claimed that

Uniflux trays cost only 40-60% as much as bubble-cap trays of the same material. This excludes shell cost.

Flexitrays

After going through a series of developments on the comparatively complex cascade and Benturi trays,[1] Koch Engineering Co. has brought out a simpler tray, the Flexitray.[2]

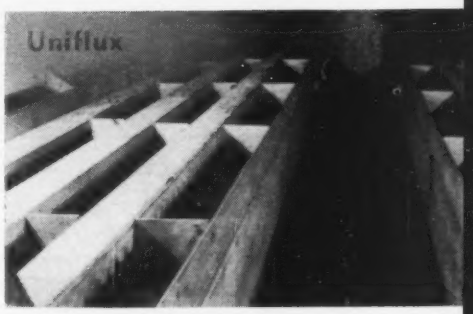
This tray (see *cut*) contains floating caps moved by vapor flow, so that the vapor opening is proportional to vapor flow up to approximately 60% of maximum vapor flow. Above this rate all caps are open. For wide ranges of operating rates, trays are equipped with caps of different weights, so that only a portion will be open at low rates, and more or all will be open at higher flow rates.

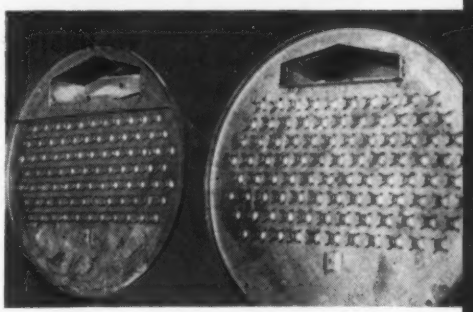
This high degree of flexibility and lower cost due to simplified construction are the major advantages of Flexitrays. It is estimated that, in general, they will cost 15% less than conventional carbon steel bubble-cap trays, and even greater savings will be realized in alloy construction. About 70 installations have been made in diameters up to 19 ft.

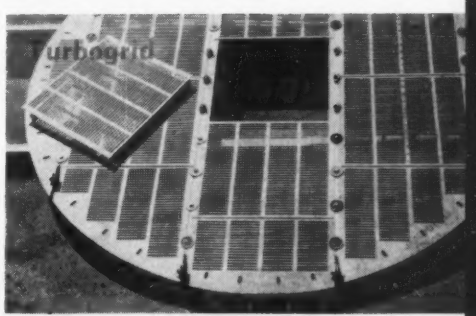
The fact that the moving part is a small domed plate operating inside a four-legged spider can lead to some difficulties. If coking occurs, the caps can stick open, with possible dumping of liquid resulting at lower than 60% of design vapor flow. Flexitrays can be cleaned very quickly, however. And extensive service with suspended solids and viscous polymeric deposits indicates that the Flexitray will remain clean longer than bubble trays.

The apparent low resistance to liquid crossflow should result in more uniform vapor distribution than obtained with bubble caps. Such improvement appears to account for the Flexitray's maximum advantage over bubble trays being when large columns or high liquid rates are involved.

On the whole, however, higher capacities of the order of 12-50% can be obtained with Flexitrays as compared with bubble-cap trays of the same diameter. This is accomplished with a high degree of efficiency and moderate pressure drop. Tray prices are 60-80% of bubble-cap trays.





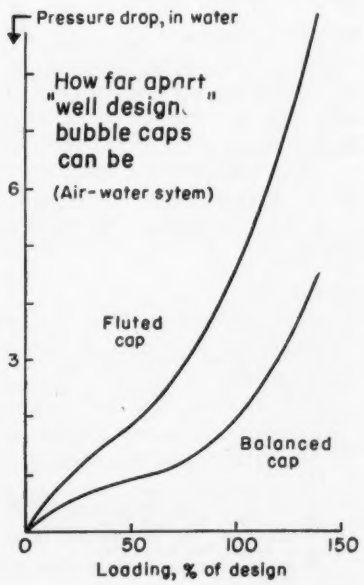


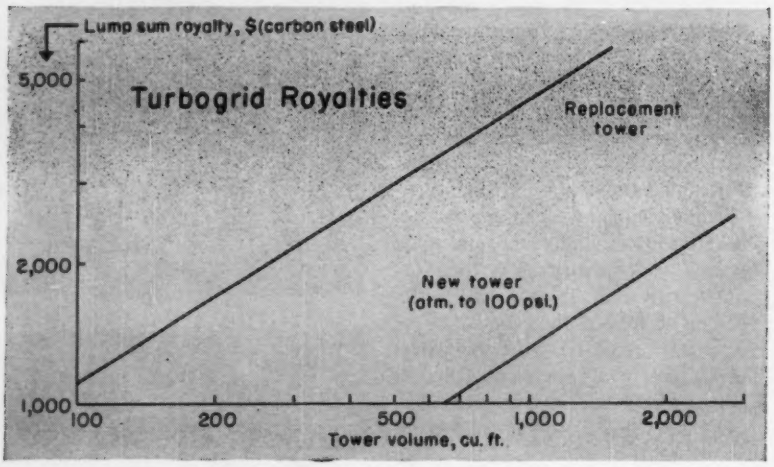
Turbogrid Trays

Simplified construction is the feature of the Turbogrid tray developed and licensed by Shell Development Co. Design from bar stock, rods or slotted plates permits fabrication with a minimum of material.

Contact is obtained by passage of vapor through interstices between bars or rods, or through punched slots. Liquid is held on the tray by the rising vapor, but open areas are sized so that liquor passes downward through the same openings. Required liquid level on the tray is maintained only by a dynamic balance of the fluid flows. In very large columns with heavy liquid downflow, it has been indicated that conventional downcomers are desirable. In some cases liquid and vapor distributor trays, and redistributors after each ten Turbogrids, have been used.

Turbogrid trays in average size towers yield low pressure drop, good contact efficiency and high capacity. The last characteristic has been noted particularly in replacement jobs, where bubble-cap trays had been loaded to the limits of their capacities. In the same shells, Turbogrid trays have yielded substantial increases in tower capacity, sometimes as much as 50%. Some 120 Turbogrid towers are now in service.





There is some lack of flexibility, however, as compared with bubble-cap trays. The tower cannot be operated over as wide a range at reasonable efficiencies, and by the same token, excessive variations in composition or rate of feed cannot be absorbed readily. When it is known that a tower will be operated at low load rates initially, and later at higher rates, sections of the Turbogrid trays first can be blanked off. This will yield higher efficiency at low loadings, and the blanks can then be removed when higher rates are desired.

The simple Turbogrid construction lends itself to economical fabrication in almost all cases, but will show particular advantages where more intractable metals or nonmetallics (glass, carbon) are required. As seen in the graphs, even for the simplest materials, such as carbon steel, appreciable reductions in tray costs are achieved. This is offset somewhat by the royalties. These are estimated to be 20% of the savings predicted in purchase of a new tower, are somewhat higher for replacement jobs.

RAPHAEL KATZEN is now in his third year as a consulting chemical engineer in Cincinnati, after 16 years of varied experience with Northwood Chemical Co., Diamond Alkali Co. and Vulcan Copper & Supply Co. He was manager of Vulcan's Engineering Division prior to setting up his own practice. He has a D. Ch. E. from Brooklyn Poly.

Perforated Trays

Perforated trays, ancient veterans of the process industries, are staging a comeback on the basis of merits which were long overlooked.

They were once used primarily as a stop-gap, particularly where sedimentation or scaling of trays was a problem. Their successful application in light hydrocarbon and air separation plants—with tray spacings as low as 2½ in.—helped establish their utility.

Chemical engineers have commonly presumed that narrow operating range characteristics were an inherent drawback of perforated trays. Recent investigations, however, of bubble formation, pressure drop and hydraulic gradient on trays have indicated that the perforated tray can be more heavily loaded than bubble-cap trays, with less entrainment and hydraulic gradient and higher efficiencies resulting. Unfortunately, not much of the recent work has yet been published. Valuable exceptions are the articles of Mayfield and coworkers[5, 6] and of Arnold and coworkers.[2]

Perforated trays still suffer from the disadvantage of alteration of hole size—by fouling with solids (restriction) or by corrosion (enlargement)—with adverse effect on pressure drop or operating range. Special care is required during the initial break-in to prevent flushing scale and dirt into perforated tray towers. Coking service should be avoided. Proper materials of construction must be used to prevent plugging or enlargement due to corrosion.

The major defect of the perforated tray, "weeping," can be overcome to a major extent by calculating minimum vapor velocities which will prevent weeping.[8]

Perforated tray towers will cost 60-70% of the cost of bubble-cap tray towers designed to do the same job. Additional savings can be expected in erection. The graph on p. 210 reports cost of perforated trays, in quantities greater than 14, made of Type 410 stainless steel, with carbon steel supports, single-flow design. For two-flow trays add 15%.

A properly designed perforated tray tower will have 10-40% greater capacity than a bubble tray tower of the same size. At any given capacity, pressure drop and hydraulic gradient of the perforated tray will be appreciably less (about 20-30%) than bubble-cap trays, while contact efficiencies will run about 10% higher.

ACKNOWLEDGMENT

Thanks to the following for supplying information for this article: F. A. Zenz (M. W. Kellogg Co.); V. O. Bowles (Socony Mobil Oil Co.); G. C. Thrift (Koch Engineering Co.); B. A. Frolov (Shell Development Co.); W. C. Schreiner (M. W. Kellogg Co.).

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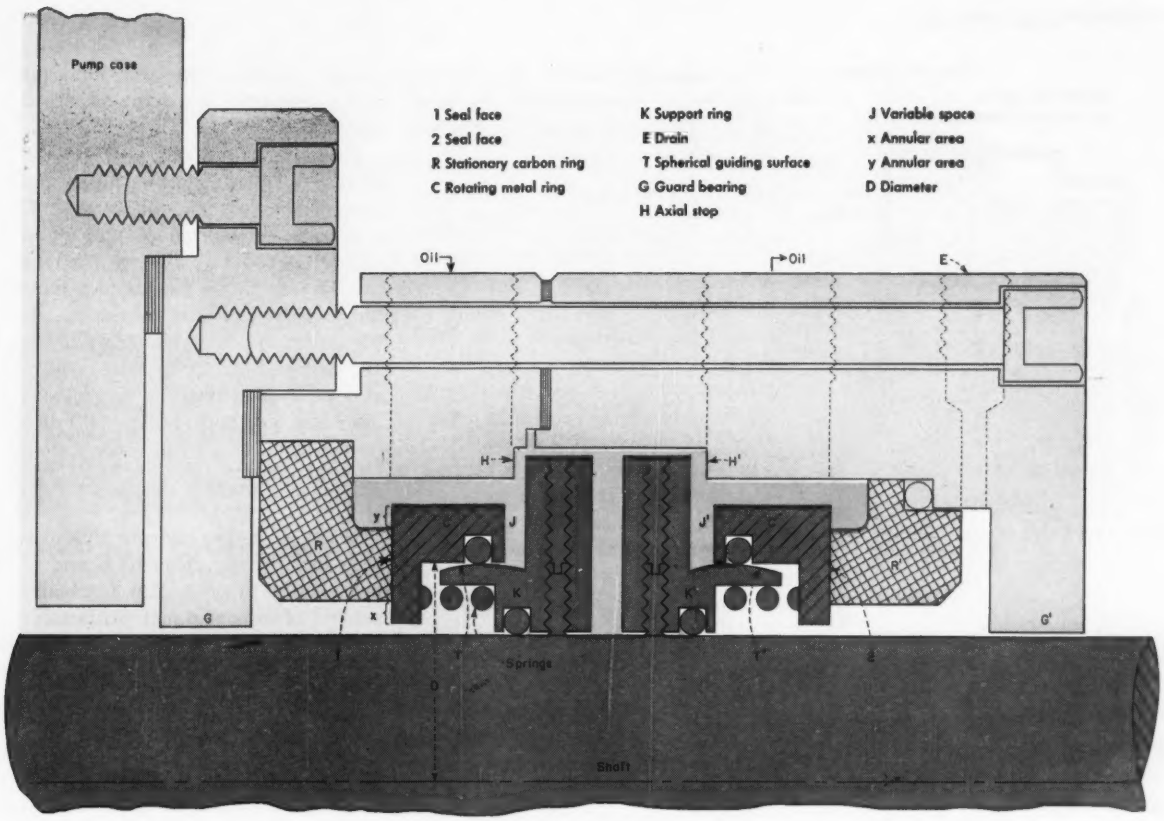


You can cut pump operating headaches and save money if you . . .

Know Your Mechanical Seals

JUDSON S. SWEARINGEN, Southwest Research Institute

A RAPIDLY increasing number of types and forms of mechanical seals for rotating shafts are becoming available. Periodically, it is desirable to review the factors which determine the choice between types of seals or between seals and stuffing boxes.

Various mechanical seals have many things in common, differing mostly in the ways they meet special requirements. This makes it easy to compare the various kinds of mechanical seals. Special cases, such as sealless arrangements and pressure-lubricated journals are not discussed here.

Generally speaking, a stuffing box, as the name implies, effects a closure by forcing a soft packing medium against a rotating shaft. On the other hand, closure between the rotating and stationary elements of a mechanical seal results from a lubricated contact between two plane, rubbing, annular surfaces ground to precision flatness. Here, we shall review shaft sealing problems to highlight the relative merits of rotating mechanical seals and stuffing boxes.

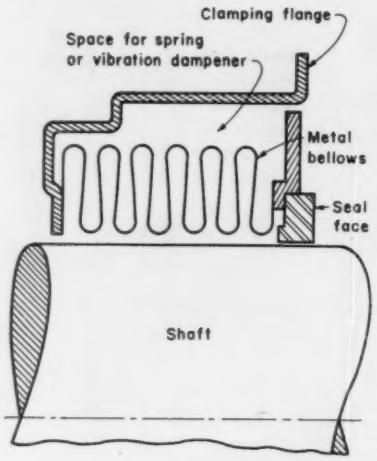
A stuffing box is acceptable where high first cost is not justified; where it simplifies a materials-of-construction problem; where maintenance is not difficult; and especially where the liquid being pumped is a reasonably good lubricant and not expensive.

Many excellent packings containing graphite or other solid lubricant are sufficiently elastic so that they will follow the deformations and motions of the shaft within small limits. They will take more abuse than can a mechanical seal, do not wear the shaft rapidly and are simple to repair.

An inherent advantage of packing is that, after abuse, repair is possible merely by tightening the gland or replacing packing. However, due to the nature of the materials involved, the leakage rate usually is considerable, especially at high speeds. Further, periodic adjustment and repacking are required.

As stated previously, two plane annular surfaces rub together to provide sealing in the mechanical seal. As long as these surfaces are kept free of abrasives and corrosive chemicals, are lubricated, are not permitted to overheat, and are not overloaded, they will have virtually indefinite life. In practice, this may be a year or longer.

In most mechanical seals the stationary surface is carbon and the rotating surface is usually phosphor bronze, Stellite, or a similar metal selected to withstand operating conditions. Seal face materials now becoming available are more resistant to



BELLOWS seal. Fulton Sylphon. Fig. 2.

wear and to high temperature. They are harder carbons for the stationary element and ceramic materials for the rotating element.

Points to Remember

Assuming that improved sealing and less maintenance will justify the added cost of a mechanical seal, its applicability depends upon its success in meeting the various requirements, especially mis-alignment, face loading, and temperature.

In practice, a seal for a rotating shaft must tolerate to a degree some or all of the following effects:

- Shaft end motion.
- Shaft "run-out" (rotation about a line spaced from the shaft center.)
- Deviation of the shaft from a position perpendicular to available faces or bores in the pump case.
- Misalignment due to thermal expansion or because of piping or structural stresses.
- Excessive seal face loading (possibly due to one or a combination of the above effects, or to high unbalanced pressure).
- Lubrication and cooling.

From the operator's standpoint, a seal should meet the following additional requirements:

- Be simple to install.
- Require a minimum of modification in the pump to accommodate it.
- Not require specialists for installation and repair.

This latter requirement has encouraged some manufacturers to offer package type seals, which are installed and replaced as a unit.

How Seal Works

Fig. 1 (p. 213) is a schematic sketch of a seal drawn somewhat out of proportion to show clearly typical methods of meeting the various requirements. A discussion of this seal emphasizes the desired features of a commercial seal so that you may recognize and evaluate any special requirements existing in specific cases.

The seal is in reality two similar seals arranged back to back to provide a chamber for circulation of coolant-lubricant. Actual sealing between case and shaft is done by pairs of mating seal faces at (1) and at (2).

At (1) one seal face is on stationary carbon ring *R* which is clamped in place against a gasket. The mating seal face is on the rotating seal ring *C* which is supported by ring *K*, which in turn is clamped to the shaft with set screws.

One O-ring prevents leakage between the seal ring and the set-screw ring, and another O-ring prevents leakage between the latter and the shaft. A spring presses the seal ring *C* axially against the stationary seal ring *R*. The right hand seal is similarly arranged.

Coolant-Lubricant

With the seal as shown, a supply of lubricating oil is pumped in at *A* and out at *B* against a back pressure greater than the pump working pressure. This supply of lubricating oil serves two purposes. First, it serves as a cooling agent in the event that temperature is a problem, and second, it assures that none of the pumped fluid, which may contain fine sand or other abrasive solids, enters seal No. 1.

If cooling is not a problem, oil need not be withdrawn at *B*. Unless conditions are ideal, a small amount of the coolant-lubricant may leak past seal No. 2 and drip out of the seal (or be drained by connection *E*) but this will be an insignificant amount.

If the pumped liquid can be filtered, a filtered stream of it may be substituted for the lubricant. If the pumped liquid does not have a serious amount of abrasive in it and cooling is not a problem, then the lubricant and also seal No. 2 may be dispensed with.

Excessive heat will damage the O-rings or other sealing members and possibly the rubbing seal surfaces. If a volatile liquid such as propane is being pumped and also used as the seal lubricant, the temperature must be well below its boiling point. At the other extreme, low temperature may cause freezing of the pumped fluid or of contaminating water which may interfere with proper seal performance.

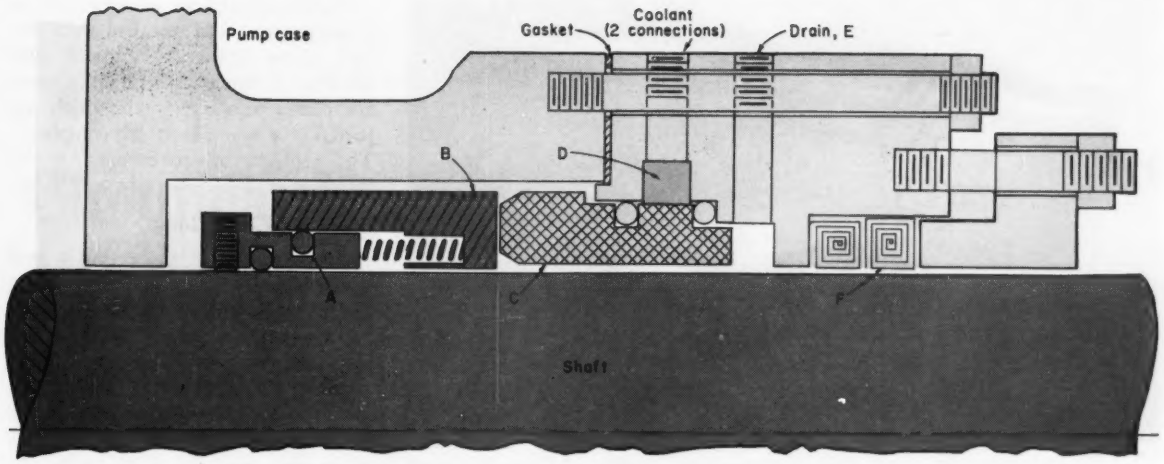
Run-Out and Misalignment

If the shaft does not run true, it is clear that the seal elements *C* and *C'* will likewise run out. Any reasonable amount of run-out is met satisfactorily by making the seal face areas of C and C' greater than those of R and R' so that full seal faces are always in contact.

If the shaft is not perpendicular to the seal face of the stationary carbon ring *R*, the seal face will still remain in contact because the O-ring in rotating element *C* seats on a spherical guiding surface, *T*.

Clearly the ring *C* can be cocked without undue friction and without losing its sealing contact with the shaft. It will have to oscillate on this spherical surface every revolution so the angularity must not be excessive or the O-ring will wear. Run-out is

JUDSON SWEARINGEN, Dir. of Petroleum Div., Southwest Research Institute, Houston, invented the ingenious seal used on thousands of stage compressors at Oak Ridge uranium diffusion plant.



RUGGED seal for high pressure, heavy duty and unusual conditions uses heavy carbon ring seal. Durametallic Corp. Fig. 3.

considered excessive if it is greater than a few thousandths of an inch.

In practice, the surface *T* need not be machined spherical because the angle is too small to make it necessary. It is shown spherical in the drawing merely to illustrate the point.

Seals containing metal or rubber bellows instead of O-ring joints are preferred for greater run-outs. In metal bellows fatigue failure must be considered.

If the seal assembly is stationary and the axially fixed member rotates, any angularity of the latter's seal face to the axis of rotation makes it necessary for the stationary member to oscillate, and then the dynamics of the system must be considered.

In the assembly of the seal, it is desirable that the carbon rings be protected radially from mechanical injury by such provisions as the guard bearing G and G′. Further, it is often desirable to have an axial limit to avoid damage in that direction, and in the drawing axial guards are illustrated by the stops *H* and *H′*.

To adjust a seal for proper spring tension the size of space openings *J* and *J′* is often specified. These spaces can be inspected through the oil connections. This is a crude provision. In many commercial seals the sealing elements can be exposed fully for inspection and adjustment.

The specification on flatness of seal faces is usually about 3 light-lines which means about 1/30th of one thousandth of an inch. This flatness will not be retained if the parts are then tightly clamped between faces which are not flat.

Two arrangements in the drawing show common methods of clamping the stationary carbon ring. On the left side the ring *R*, is shown clamped against a soft gasket. If this should distort the face slightly, it will wear flat. Since it is firmly held it will then operate satisfactorily after this break-in period, which may require several days.

In the illustration on the right, the carbon ring *R′*, is mounted loosely, sealed by an O-ring, and keyed with a pin (not shown) to prevent rotation and possible damage to the O-ring. (At the option of the designer, the arrangement may be reversed so that *R′* floats axially and *C′* is fixed axially.)

Balancing Pressure

In the selection of seals the expressions "balanced" and "partially balanced" are encountered. The hydrostatic pressure at various points in the oil film between the faces of a seal is usually directly proportional to the radial position across the seal face, but occasionally it is somewhat higher than this linear variation. For illustrative purposes, let us assume that the variation in pressure is linear and that we wish to balance the seal exactly.

Referring now to seal No. 1, Fig. 1, the movable element of the seal which is to be balanced is the metal ring C. Balancing refers to the arrangement which would make the axial position of C insensitive to the pressure difference across the seal.

It is obvious that the annular areas x and y are of no significance and could be removed without affecting the seal balance. The pressure acting to force the ring *C* to the right is the summation of pressures existing within the lubricating film between the mating sealing faces.

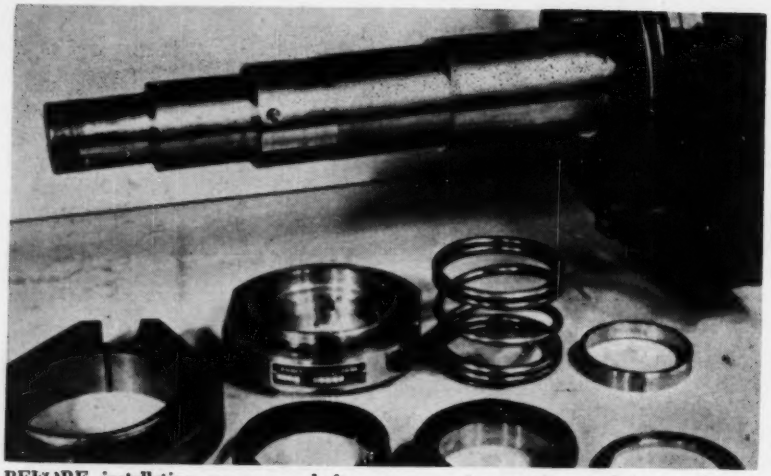
It has been assumed that this pressure is linear decreasing toward the axis of rotation. The seal would be balanced if half of this annular area is opposed by high pressure sealing fluid in the space *J* and the other half opposed by low pressure system fluid in the spring chamber. This is accomplished if the diameter *D* is essentially at the mid-point of the effective seal face. (The drawing illustrates it in this position.)

Usually it is not desirable to completely balance a seal. As stated above, the pressure prevailing between the seal faces often is higher than average. Complete balancing might result in the seal actually being overbalanced so that the faces might be forced apart making leakage excessive.

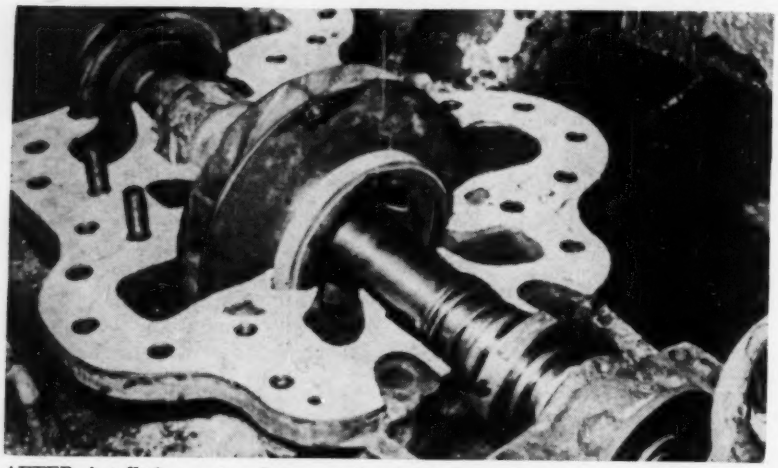
For low and moderate pressures, balancing is not necessary. However, for high pressure-difference it is essential that most of the hydraulic seal load be alleviated by balancing.

Other Commercial Types

With this explanation, two additional figures of actual commercial



BEFORE installation on pump shaft you see spring, retainer and two seal rings.



AFTER installation, external type seal extends beyond pump case. Sealol Corp.

seals show provisions for meeting these requirements to varying degrees. Usually, compromises are necessary to favor the problems which are most important.

Fig. 2 is a bellows-type seal in which the stationary element is mounted on a flexible bellows and thrust against the rotating face by a spring, not shown, or by bellows compression. Bellows serves to support the seal face in a variable axial position and it insulates the seal ring against clamping stresses and possible damage.

Further, there is an opportunity for balancing through matching of mean diameters of seal face and bellows. Guides and stops also can be provided to protect the seal or bellows, and to damp possible vibrations or chatter. For moderate pressures these seals are very satisfactory.

For high pressures, heavy duty and unusual conditions, rugged seals similar to the one drawn in Fig. 3 are necessary. Note that the sealing face is balanced by O-ring *A*, and that rotating sealing ring *B* has a large cross-section to increase strength and maintain seal face flatness. (Such a heavy section mounted on a bellows might set up vibrations.)

The carbon ring *C* is heavy, is replaceable, may be provided with lubrication, and is jacketed at *D* for cooling. There is a leakage vent *E* and an auxiliary stuffing box *F* to contain any leakage. Stuffing box *F* may be replaced by a close-fitting bushing in most cases.

This seal obviously requires considerable adjustment in order to be fitted properly and installed with correct spring tension, alignment, and the like. If this is objectionable, most companies also offer seals which are partially or completely self-contained. The problem of space may prevent their use, and they usually cost more.

Extreme Conditions

The question of protecting a seal from abrasives is met in various ways. For instance, a small amount of sealing fluid can be introduced near the seal to flow into the pump. This clean liquid may be a filtered stream from the pump discharge. Some manufacturers offer a crude rubber seal to protect the seal faces from abrasives.

The pressure against which it is practical to seal depends upon the designer's ability to prevent seal face injury. Flatness of seal faces must be assured by maintaining uniform temperature and indifference to pressure stresses, balancing the seal to minimize seal face loads, lubrication, and speed of rotation. With reasonable construction it is possible to seal satisfactorily several hundred psi. at 3,600 rpm. with a shaft several inches in diameter.

Some seals use O-rings and others use chevron packing. O-rings are more convenient but are not available in Teflon which is sometimes required.

Gases may be sealed as well as liquids. It is only a matter of lubricating the seal face by introducing a few drops an hour of oil between the seal faces, usually through a small hole within the carbon ring.

Summarizing—for low pressures, simple rubber-mounted or bellows-mounted mechanical seals have largely replaced stuffing boxes except for special materials such as liquid ammonia. For heavy duty applications and high pressures, the seal parts of a mechanical seal must be precision-made and mounted so that they will operate under all of the conditions to be encountered.

When these requirements are met, the leakage rate is extremely low and the seals have long life. There must be no compromise on meeting the mechanical requirements, as failure to do so is equivalent to deliberately providing conditions which will damage the seal.

CE REFRESHER

Chemical Engineering Fundamentals

General Considerations in Reactor Design—III

T. E. CORRIGAN and E. F. YOUNG, Olin Mathieson Chemical Corp., Brandenburg, Ky.

Last month (*Chem. Eng.*, Oct. 1955, p. 211) we showed that backmixing has an important effect on simple reactions in flow reactors.

We'll expand this now to include backmixing equations for the case of fractional order and second order reactions.

Backmixing Effect on Second-Order Reactions

If a reaction were second order, the basic rate equation would be

$$dC_A/dt = -kC_A^2$$

and the steady-state material balance would be

$$FC_{Ao} - FC_A = kC_A^2V$$
$$C_{Ao} - C_A = k(V/F)C_A^2$$

This is soluble as a quadratic.

$$k(V/F)C_A^2 + C_A - C_{Ao} = 0$$
$$C_A = [(F/V)^2(\tfrac{1}{4}k^2) + (F/V)(C_{Ao}/k)]^{0.5} - (F/V)(\tfrac{1}{2}k)$$

Or, letting $a = F/2Vk$

$$C_A = [a^2 - 2aC_{Ao}]^{0.5} - a$$

Backmixing Effect: Fractional-Order

We can also derive equations for fractional-order reactions. For example, if the reaction were ½-order,

$$-dC_A/dt = kC_A^{0.5}$$
$$C_{Ao} - C_A = k(V/F)C_A^{0.5}$$

Squaring both sides of this equation and solving as a quadratic, gives us

$$C_A = C_{Ao} + (k^2/2)(V/F)^2 - k(V/F)[C_{Ao} - (k^2/4)(V/F)^2]^{0.5}$$

Nomenclature (Consistent Units)

a	See explanation this page
a, b	Initial charge of A, B in concentration units
A, B	Reactants
c	$a + b$
C	Concentration of
C_{Ao}, C_{Bo}	Initial concentration of A, B
d	Differential operator
e	2.7183
F	Feed rate
k	Rate constant
M	Molar ratio
n	Order of reaction
r	b/a
R, S	Products
t	Holding time in a batch or longitudinal flow reactor
t_b	Holding time in a backmix reactor
V	Volume
x	Degree of conversion in a batch or longitudinal flow reactor
x_b	Degree of conversion in a backmix reactor.

In this case, if we let $a = kV/F$,

$$C_A = C_{Ao} - 0.5a^2 - a[C_{Ao} - a^2/4]^{0.5}$$

The table presented below is a summary of the rate equations for the reaction of A going to R for first, second and one-half order reactions; and for batch, longitudinal flow and backmix reactors.

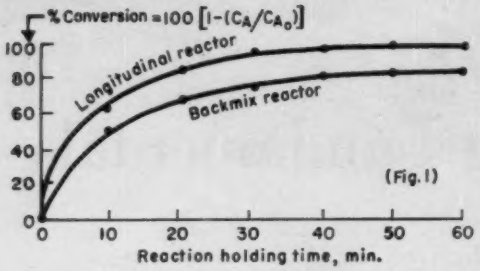
Backmix vs. Longitudinal Flow Reactors

To illustrate the effect of backmixing of a simple reaction (first order), we have worked out a case com-

Effect of Backmixing on the Simple Reaction A→R

Order of Reaction, n	Rate Equation, No Backmixing (Batch Reactor, Longitudinal Flow Reactor)	Rate Equation with Backmixing (Stirred Tank, Packed Tower, Baffled Tank etc.)
1	$C_A = C_{Ao}e^{-kt}$	$C_A = C_{Ao}/[k(V/F) - 1]$
2	$1/C_A = (1/C_{Ao}) + kt$	$C_A = a^2 + 2aC_{Ao}^{0.5}$; where $a = F/2Vk$
½	$C_A = [C_{Ao}^{0.5} - 0.5kt]^2$	$C_A = C_{Ao} + 0.5a^2 - a[C_{Ao} - (a^2/4)]^{0.5}$; where $a = kV/F$

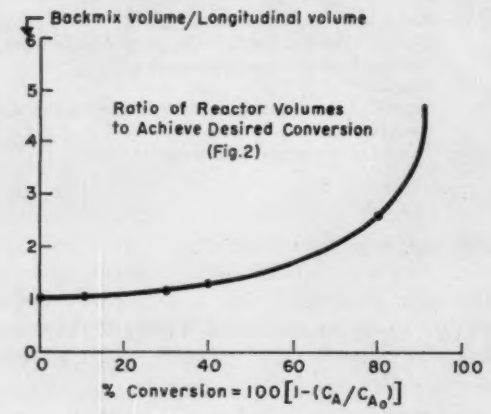
How Backmixing Slows Conversion



Longitudinal Reactor: $C_A = C_{Ao}e^{-kt}$
Backmix Reactor: $C_A = C_{Ao}/(kt + 1)$
% Conversion = $100[1 - (C_A/C_{Ao})]$
If we assume that $k = 1.0$, then

t, Min.	Longitudinal Reactor % Conversion	Backmix Reactor % Conversion
10	63	50
20	86	67
30	95	75
40	98	80
50	99.3	83
60	99.8	86

Volume Needed for a Given Conversion



paring the backmix with the longitudinal flow reactor (see Figs. 1 and 2).

Note that Fig. 1 is a plot of percent conversion for a given feed rate vs. the holding time in the reactor. The upper curve is for a longitudinal reactor and the lower curve for a backmixing reactor. These curves were calculated for the hypothetical case where the reaction is first order and $k = 0.1$/min.

We can see that where the conversion per pass is low, the effect of backmixing is small. For instance, at 20% conversion the holding times are 2.24 min. and 2.50 min. for longitudinal and backmixed reactors respectively; at 50% conversion the holding times are 6.9 min. and 10 min.

The effect of backmixing becomes especially great at high conversions. At 85% conversion, the required holding times are 19 min. and 57 min. respectively.

How the backmixing effect increases with conversion is shown in Fig. 2. This is a plot of the ratio of reactor volume required for backmix reactor to that required for a longitudinal reactor as the required conversion increases. At 70% conversion the required volume is doubled but at 85% conversion, five times the volume is required.

Note that for a first-order reaction, the ratio of reactor volume required (or the required holding time) is a function of the percent conversion only. The ratio does not depend on the value of the rate constant.

Therefore, the curve in Fig. 2 will hold for any first-order reaction. We can show this as follows:

Longitudinal Reactor

$$\text{Conversion} = x = 1 - e^{-kt}$$
$$1 - x = e^{-kt}$$
$$\ln (1 - x) = -kt$$
$$t = -[\ln (1 - x)]/k$$

Backmix Reactor

$$\text{Conversion} = x = 1 - [1/(kt_b + 1)]$$
$$1 - x = 1/(kt_b + 1)$$
$$1/(1 - x) = kt_b + 1$$
$$t_b = (1/k)[x/(1 - x)]$$

We can set up the ratio of holding times for the backmix reactor and the longitudinal reactor as t_b/t. Then,

$$t_b/t = \frac{(1/k)[x/(1 - x)]}{(1/k) \ln (1 - x)}$$

The rate constant drops out and the effect of backmixing is the same for all first-order reactions of the type A going to R regardless of the value of the rate constant.

What About Reactant Ratio?

In any reaction involving two components such as

$$A + B \rightarrow R$$

there is the question of what ratio of reactants should be used. The general differential equation for this type of reaction is

$$dx/dt = k(a - x)(b - x)$$

If we let $r = b/a$, and consider that for any reactor volume $a + b = c$, then

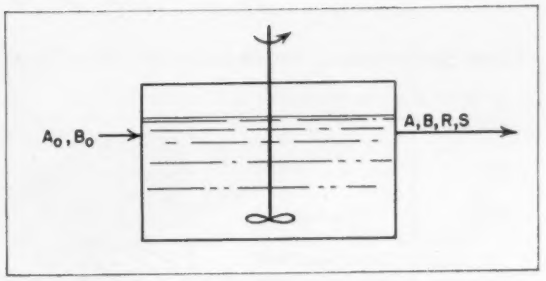
$$a = c - ar \qquad b = ar$$
$$dx/dt = k(c - ar - x)(ar - x)$$

The quantity $(dx/dt)\ (1/k)$ is a maximum when the product $(c - ar - x)\ (ar - x)$ is a maximum. We can show that this quantity is a maximum when $r = 1.0$; i.e., when the initial concentrations of A and B are equal. Therefore, in the general case, the smallest reactor size for a given production rate or the greatest conversion possible in a given reactor is achieved when stoichiometric quantities are charged.

There are certain considerations which may indicate that other ratios may be best in specific cases. For example, if A is a much more valuable raw material than

B, it will probably be desirable to have a high ratio of B to A in the feed. Even though this may increase the size of reactor required it will maintain extremely low residual concentrations of the expensive material, A.

Or, if it is difficult or impossible to recycle one component (such as a substance that would decompose when distilled) it may again be desirable to sacrifice reactor size to over-all economy. We would use a high initial and residual concentration of the component that can be recycled.



Backmixing Effect: A+B→R+S

We have shown above the effect of complete backmixing on the reaction of A going to R. The ratio of the holding time required in a backmix reactor to that required in a longitudinal reaction is a function of conversion. Further, for a first-order reaction this ratio is independent of the actual reaction constant.

The effect of backmixing on a reaction such as

$$A + B \rightarrow R + S$$

where the reaction is second order, is similar. We show a plot of the ratio of backmixing holding time to longitudinal or batch holding time in Fig. 3. The mole ratio of reactants in the feed is a parameter.

The equation for a batch or longitudinal reactor has been derived in the classical literature on this subject. We will present the equations here but not the derivations. For a reaction such as

$$A + B \rightarrow R + S$$
$$-dC_A/dt = kC_AC_B$$

If we let a = initial charge of A (concentration units); b = initial charge of B (concentration units); and x = conversion (moles of A reacted), then

$$-d(a - x)/dt = k(a - x)(b - x)$$

or,

$$dx/dt = k(a - x)(b - x)$$

In the case where a does not equal b,

$$\frac{1}{a - b} \ln \frac{b(a - x)}{a(b - x)} = kt \qquad (1)$$

In the case where a equals b,

$$dx/dt = k(a - x)^2$$

and

$$x/[a(a - x)] = kt \qquad (2)$$

Eqs. (1) and (2) for longitudinal flow or batch reactors appear in physical chemistry and chemical kinetics texts. The corresponding backmixing equation for second-order reactions of this type does not appear and so it will be presented here.

The equation for backmixing is derived by a material balance over a steady-state reactor in the same way that the first-order equation was derived last month (*Chem. Eng.*, Oct. 1955, p. 214).

With the sketch at the top of the next column as our guide, if we perform a material balance on A, the resulting equation is:

$$FC_{Ao} = FC_A - kC_AC_BV$$

where F = feed rate expressed on a volume basis; C_{Ao} = concentration of A in the feed; and V is reactor volume.

$$FC_{Ao} - FC_A = kC_AC_BV$$
$$C_{Ao} - C_A = k(V/F)C_AC_B$$

In terms of conversion,

$$C_{Ao} - C_A = x$$
$$C_A = a - x$$
$$C_B = b - x$$

where $a = C_{Ao}$; and $b = C_{Bo}$. Then,

$$x = k(V/F)(a - x)(b - x)$$

or

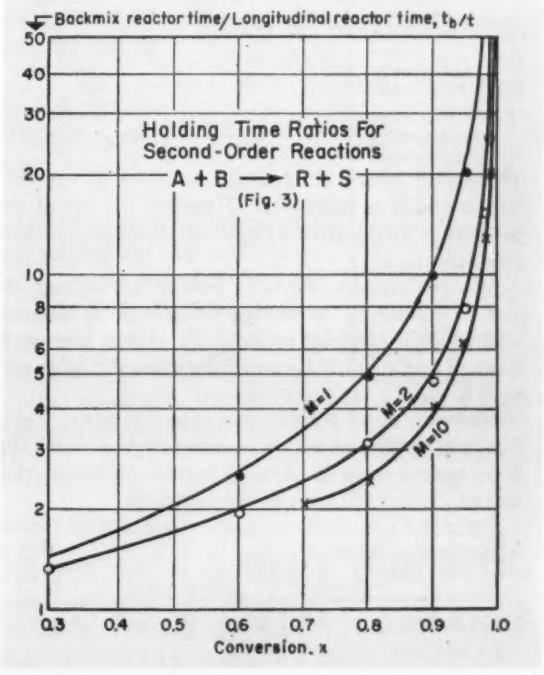
$$k(V/F) = x/[(a - x)(b - x)] \qquad (3)$$

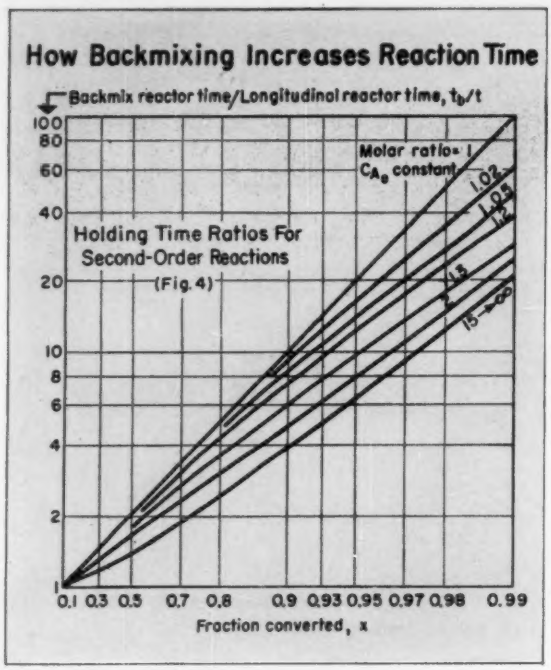
In terms of holding time

$$kt = x/[(a - x)(b - x)] \qquad (4)$$

A chemical engineer is interested in the effect of backmixing for a given reaction (i.e., the same value of k). The usual questions that he asks himself are:

- What additional holding time, or reactor volume, would be needed to compensate for backmixing if it is present?
- For a reactor of given size, what would be the decrease in conversion caused by backmixing?





The first question involves the ratio of backmixing holding time, t_b, to longitudinal holding time, t, at equal values of conversion. The second question involves the ratio of backmixing conversion, x_b, to longitudinal conversion, x.

Effect on Volume at Same Conversion

The equation for a given conversion is obtained by dividing Eq. (4) by Eq. (2).

$$kt_b/kt = \frac{x/[(a-x)(b-x)]}{[1/(a-b)]\ln[(ba-bx)/(ab-ax)]}$$

$$t_b/t = \frac{x(a-b)}{(a-x)(b-x)\ln[(ba-bx)/(ab-ax)]} \quad (5)$$

This equation can be expressed as a plot of t_b/t vs. x with a and b as parameters. However, the use of two parameters would make a two-dimensional plot virtually impossible.

We can simplify Eq. (5) further by defining the unit of volume in the concentration term as that volume which is occupied by one mole of A at feed conditions. Then a equals 1.0 and b becomes the mole ratio of B to A.

However, a and b are in concentration units. Therefore, we want to express x in concentration units also. If we want x to be in terms of fraction of A converted, we can change the form of the equations.

Let $x = C_{A_o}x_c$, where x_c is the conversion in concentration units. Then,

$$a = C_{A_o} \qquad b = C_{A_o}M$$
$$a - x = C_{A_o}(1-x)$$
$$b - x = C_{A_o}(M-x)$$
$$a - b = C_{A_o}(1-M)$$

Substituting into Eq. (5) gives us the following equations:

$$\frac{kt_b}{kt} = \frac{C_{A_o}x/[C_{A_o}^2(1-x)(M-x)]}{\frac{1}{C_{A_o}(1-M)}\ln\left[\frac{MC_{A_o}C_{A_o}(1-x)}{C_{A_o}C_{A_o}(M-x)}\right]}$$

or,

$$\frac{t_b}{t} = \frac{x(1-M)}{(1-x)(M-x)\ln[(M-Mx)/(M-x)]} \quad (6)$$

This compares with the first-order expression that we developed above:

$$t_b/t = \frac{-x}{(1-x)\ln(1-x)} \quad (7)$$

As the mole ratio of B to A in the feed becomes greater, the second-order reaction behaves more and more like a first-order reaction. Eqs. (6) and (7) become identical in form at an infinite mole ratio of B to A in the feed. This is the case of a "pseudo first order reaction and is common where one reactant reacts with the solvent.

We can show this mathematically quite easily. Start with Eq. (6) and divide both the numerator and denominator by M. Let M equal infinity and we get an equation that is identical with Eq. (7), the first-order equation.

In Fig. 3 we show a plot of the ratio t_b/t vs. x. Curves are shown for mole ratios of 1, 2 and 10. Note that the value of t_b/t becomes very large as conversion approaches 100%. Although these curves are helpful for visualizing the effect of backmixing, they are difficult to use because of their steep slopes at high conversions.

An improved method of plotting these ratios has been developed by G. A. Lessels in a paper now being prepared for publication. Lessels plots the ratio t_b/t vs. the fraction of A unconverted on log-log paper. On this type of plot, Fig. 4, the actual curves are more nearly linear.* Except for the case of a 1-to-1 mole ratio they are not quite linear.

We can see also from Fig. 4 that as the mole ratio of B to A in the feed approaches infinity, the curve for the second-order reaction approaches that for a first-order reaction.

*Fig. 4 is reproduced by permission of G. A. Lessels, Development Engineer, Hydrocarbon Chemical Division, Olin Mathieson Chemical Corp., Brandenburg, Ky.

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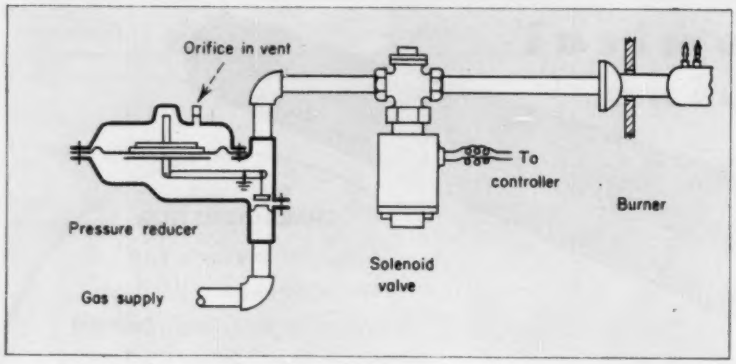

★ **Winner of August Contest**

Low Cost Method Controls Gas Burner

David E. Morris

Chemical Engineer, Mallinckrodt Chemical Works, St. Louis, Mo.

Oftentimes it is possible to secure satisfactory temperature control of gas-fired equipment with an on-off controller. However, there is the problem of preventing flashback in the burner if the combustion chamber is cold. To avoid this, it is common practice to use a motor-operated valve in the gas-supply line. Since a valve of this type is slow in operation, this insures that the gas supply will be turned on slowly when the controller calls for heat.

A simple and much cheaper method which attains the same result is to use a solenoid valve instead of a motor-operated valve—and then make a slight modification in the gas pressure-reducing valve. Without the modification, the solenoid valve, which opens with a snap type of action, would instantly permit a full flow of gas through the burner. In larger solenoid valves with an external spring, this characteristic could probably be overcome satisfactorily through the addition of a dash pot. But in smaller valves with the entire mechanism enclosed, this solution is not available.

Instead, with smaller solenoid valves, the pressure reducer can easily be modified to give slow opening. A diaphragm type pressure reducer would be provided for the installation in any case. When the controller calls for no flow and the solenoid valve closes, pressure on the downstream side of the reducing valve builds up against the diaphragm and closes the valve. Now, if the vent above the diaphragm is throttled by means of an orifice, then the slow leakage of air through the orifice will prevent rapid movement of the diaphragm when a call for more heat opens the solenoid valve. Hence the reducing valve will open slowly, and its rate of movement can be controlled within limits by the size of orifice used.

A simple way to make the orifice is to attach a $\frac{1}{8}$-in. ips. x $\frac{1}{4}$ in. copper tube fitting to the vent. This is plugged and drilled with a 0.010-in. hole. Then the hole can be peened smaller until the desired slow rate of opening is obtained. A prick punch is handy for this peening operation. A control of this sort has been operating for three years without attention.

Quick Identification for Your Process Piping

Thomas Garcia B.

Rice Institute, Houston, Tex.

Process piping is commonly identified by color coding. For example, the standard colors of the ASME code are: Red, fire protection; Yellow, dangerous; Green, safe; Blue, protective; and Purple, extra valuable. To give more specific identification, various plants

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★ **Winner of September Contest:**

Condensed Steam Can Provide Clean Water Under Pressure For Pump Lantern Glands.

As winner of the September Plant Notebook Contest, this article has earned a prize of $50 in cash for Edward J. Gibbons and James Ulrich, who are mechanical engineers in the Research and Development Dept. of Colgate-Palmolive Co., Jersey City, N. J. Their idea provides seal water for pumps at very little added expense.

$50 PRIZE FOR A GOOD IDEA—Until further notice the Editors of *Chemical Engineering* will award $50 cash each month to the author of the best short article received that month and accepted for the Plant Notebook.

Each month's winner will be announced in the issue of the second following month, and published the third following month.

$100 ANNUAL PRIZE—At the end of each year the monthly winners will be rejudged to determine the year's best Plant Notebook article which will then be awarded an addition $100 prize.

HOW TO ENTER CONTEST—Any reader of *Chemical Engineering*, other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 500 words, but illustrated if possible. Acceptable nonwinning articles will be published at regular space rates ($10 minimum).

Articles may deal with plant or production "kinks," or novel means of presenting useful data, which will interest chemical engineers. Address Plant Notebook Editor, *Chemical Engineering*, 330 West 42nd St., New York 36, N. Y.

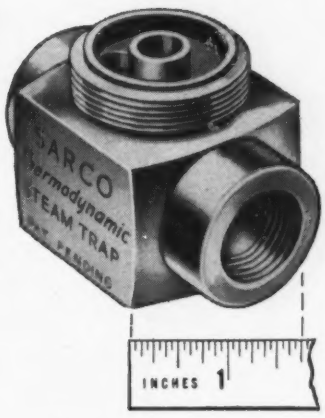
Now — A Revolutionary NEW Steam Trap!

What could be simpler?

1. A CAP →

2. A DISC →

3. A BODY →



That's all!

Practically Eliminates Maintenance!

Look at this revolutionary new thermodynamic steam trap. Could it possibly be simpler? Look for the valve closing mechanism—there isn't any! The kinetic energy of steam closes the valve and *only* the TD uses this new operating principle.

Only 3 parts... cap, disc and body... machined from stainless steel bar stock... all extremely simple, rugged, durable. Only one moving part... a hardened SOLID stainless steel disc... practically wear-proof.

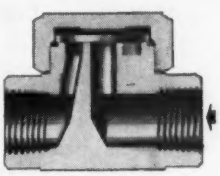
Just imagine how much time and expense this new TD steam trap can save you by greatly reducing and simplifying trap maintenance and inventory!

SOME OF MANY OTHER ADVANTAGES:

1. Use the same trap for 10-600 psi... for light or heavy loads ... without seat or valve change or other adjustments.
2. Closes tight on no load — no steam waste.
3. Operates against back pressures up to 50% of inlet pressure.
4. Not affected by superheat, water-hammer, corrosive condensate.
5. Only one spare part—solid stainless steel disc.

TROUBLE-FREE DESIGN

No valve-closing mechanism to wear or stick—the kinetic energy of steam closes the valve. No critical clearances to choke. No gaskets to leak. Only one moving part—a SOLID stainless steel disc.



Ask for a 60 day trial installation of Sarco TD trap and strainer... write for bulletin 257. Sarco Co., Inc., Empire State Bldg., New York 1, N. Y.

SARCO

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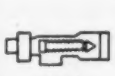
Only Sarco Makes All 5 Types

That's why Sarco can give impartial advice on proper steam trap selection.

Thermodynamic Steam Traps

Thermostatic Steam Traps

Float Thermostatic Steam Traps


Liquid Expansion Steam Traps

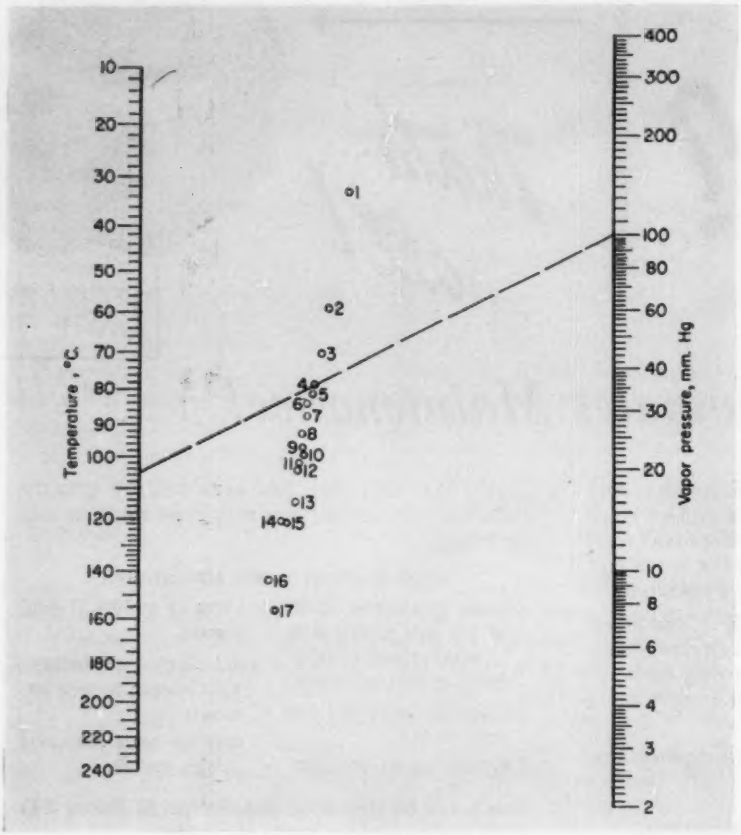
Camlift Bucket Steam Traps

adopt their own color codes, and some stencil the names of the fluids on the lines.

Both methods are somewhat time consuming and in dark locations the identification by color may not always be easy. It has therefore occurred to me that the possibility of using reflective pressure-sensitive tape would be worth exploration. Such tape is readily available, although not in a full range of colors. It takes very little light to make it show up unmistakably—witness the color strips often used on the rear of automobiles. It is not difficult to cut arrows from it to show flow direction, and it might be feasible for large users to have cutting dies made with which block letters could easily be cut to form word labels.

Minnesota Mining & Mfg. Co. is the principal source for these reflective tapes, which are made under the name of Scotchlite. The colors at present available include red, silver-white, yellow, and gold. The Meyercord Co. makes fluorescent colors which also might be adaptable for this purpose.

NOTE: *Frequent contributor Garcia, who will be remembered as the former chief chemist of Petroleos Mexicanos at Poza Rica, Ver., Mexico, is now taking graduate studies at Rice Institute.*—EDITOR.



Substances Included in the Chart

1	Benzene
8	1, 4 Bromochloro benzene
12	1, 4 Dibromo benzene
6	1, 2 Dichloro benzene
4	1, 3 Dichloro benzene
5	1, 4 Dichloro benzene
17	Hexachloro benzene
3	Monobromo benzene
2	Monochloro benzene
7	Monoiodo benzene
16	Pentachloro benzene
15	1, 2, 3, 4 Tetrachloro benzene
13	1, 2, 3, 5 Tetrachloro benzene
14	1, 2, 3, 5 Tetrachloro benzene
11	1, 2, 3 Trichloro benzene
10	1, 2, 4 Trichloro benzene
9	1, 3, 5 Trichloro benzene

Vapor Pressures of Benzene Halides

Om P. Kharbanda

Research Dept., Simon-Carves Ltd., Stockport, England.

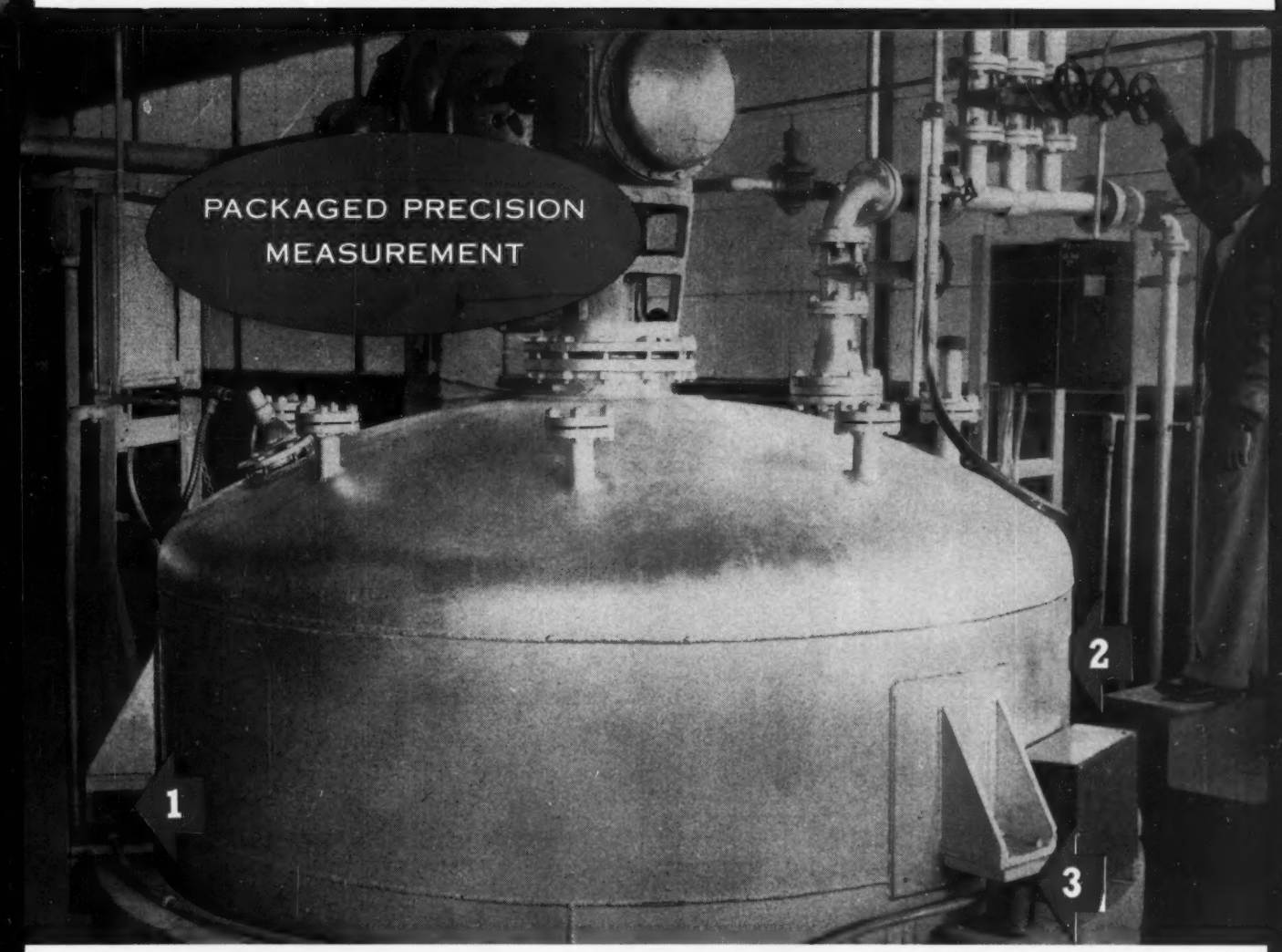
Growing importance of the various chlorobenzene isomers has prompted the author to prepare the nomogram above to give vapor pressures of all the benzene halides for which the data are included in Stull's excellent vapor pressure compilation (*Ind. Eng. Chem.*, 39, 517, 1947).

Use of the nomogram is very simple. For instance, to find the vapor pressure of 1, 3 dichloro benzene at 105 C., locate the number of this compound as 4 in the table and extend a line through 105 and Point 4 to cut the vapor pressure scale at 100 mm. Hg.

If desired the vapor pressure scale can easily be extended upward to 1,000 mm., or downward to 1 mm. The scale is logarithmic and the extensions can be calibrated from the corresponding portions of the 10-100 mm. part of the scale.

Light on Static

Development of static electricity by rubber belts can build up enough potential to be dangerous in some cases, requiring conductive belts. Dayton Rubber Co. researchers have found that holding a 1/25-watt neon glow bulb near a charged V-belt will actually light the bulb if static is present. Some kind of insulated holder such as a pencil is recommended since there may be enough potential to knock the bulb from your hand.



Naugatuck Chemical speeds up latex compounding 50%, cuts costs with Baldwin SR-4® Load Cells

Baldwin's *Packaged Precision Measurement* has speeded up compounding of natural latex with synthetic latices by 50% at Naugatuck Chemical, Division of U. S. Rubber Company, Los Angeles, California. Three SR-4 load cells weigh this compounding tank continuously and accurately as each latex is added.

The previous method of compounding proved costly for only one latex could be measured volumetrically. Two or more others had to be taken from bulk storage, weighed in small batches and dumped into the tank manually. Latices now are pumped directly from bulk storage into the tank through control valves over the indicator, permitting the operator to control the flow of each latex while watching the indicator. A flexible link in the piping eliminates any effects on weighing accuracy.

Baldwin's simplified weighing system solved Naugatuck's problem efficiently and economically by supporting a 4000-gallon tank on three 20,000 lb. Type C load cells. Electrical output of these cells is totalized on a direct reading indicator. Over-all system accuracy guarantee is ¼% of tank capacity of 40,000 lbs., or within 100 lbs. of any reading.

Naugatuck has found their new Baldwin system has greatly increased accuracy of compounding. They know they can count on Baldwin tank weighing systems for similar ones are in service at their Naugatuck, Conn. and Baton Rouge, La. plants.

Let *Packaged Precision Measurement* work for you. For detailed information on SR-4 Device applications and instrumentation write us or use the coupon today.

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Eddystone Division
BALDWIN-LIMA-HAMILTON

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Please send me the following new literature:

- ☐ Bulletin 4300 (Introduction to SR-4 Devices)
- ☐ Bulletin 4301 (SR-4 Load Cells and Load Beams)
- ☐ Bulletin 4302 (SR-4 weighing of tanks, bins, hoppers)
- ☐ Bulletin 4306 (SR-4 Fluid Pressure Cells)

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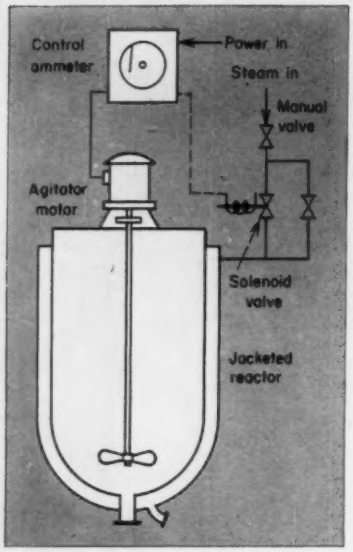


End-Point Control Via Viscosity

Anthony P. Massa

Process Engineer,
The H. K. Ferguson Co.,
New York, N. Y.

Viscosity of a reaction mixture can be used as the basis for stopping a reaction at its optimum endpoint. For example, in cooking varnishes and other polymerization or esterification reactions, the reactants are allowed to react under reflux conditions for a certain period of time. During this time the reaction or polymerization proceeds and both the temperature and the viscosity of the mixture increase gradually.

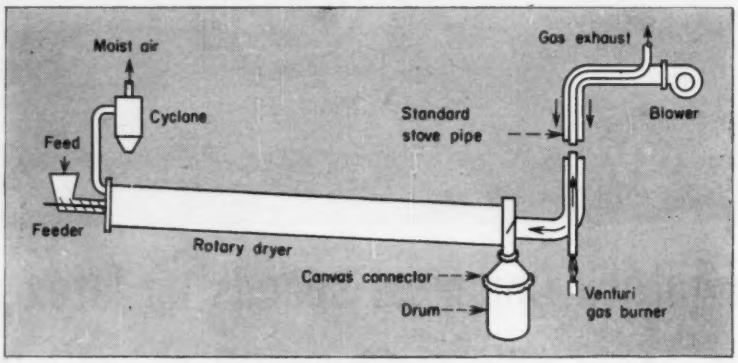
When the proper degree of polymerization has been reached, as indicated by the viscosity, the steam is cut off the reactor jacket and the reaction is allowed to slow down and stop.

A simple way to accomplish this automatically is to connect the electric power circuit leading to the agitator motor through an on-off controlling ammeter, or ammeter connected to a high-limit current switch. When the viscosity of the mixure reaches a predetermined value corresponding to the desired degree of polymerization, the power and current required by the agitator motor will have become high enough to trip the control and close the solenoid valve in the steam line to the jacket.

The best way to work out the valve arrangement is to use a normally open solenoid valve in series with a manually operated steam valve which is adjusted so that the quantity of steam admitted is enough to heat up the reactor and keep the reaction going at a constant rate. The steam should be sufficient to cause a small amount of continuous refluxing. After the initial adjustment the varnish cooking, or polymerization of resin or polymer, can be done automatically without direct observation or sampling of the product to determine when to stop the reaction.

When the system is first put into operation it is necessary, of course, to follow the viscosity increase by sampling and comparing the increase with the indications of the ammeter. When this correlation has been determined the high-limit switch can be set to close at the desired value of current to the agitator motor, so as to pass current to the energizing coil of the solenoid valve, closing it and shutting off the steam supply. This causes the polymerization reaction to first slow down, then to stop eventually.

This system, eliminating need for continuous direct observation by the operator, is especially useful for endothermic reactions which take a long time for competion.



One Way to Get Warm Air for Drying

R. W. Moore

Metallurgist, Attleboro Refining Co., Attleboro, Mass.

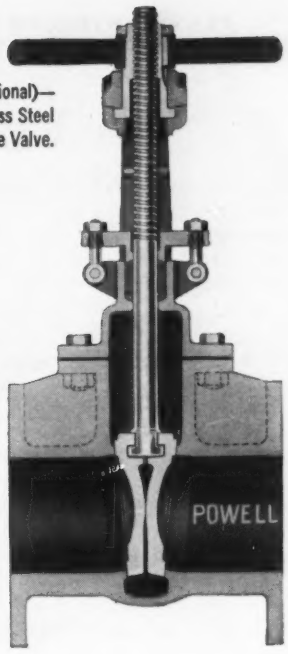
In drying heat-sensitive hydrated crystals it is important to maintain a low relative humidity in the drying air. On this account it is not desirable to mix the drying air with the products of combustion of the gas burned to supply the heat. To do so would introduce too much moisture and raise the relative humidity of the mixture. Something like a pound of water is produced in burning each pound of gas.

We had the problem of drying a hydrated nickel sulfate crystal of about 20 mesh size. This crystal breaks down at about 110 F., giving up its water of crystallization. On this account we wished to keep the drying air temperature below 120 F. However, this temperature would be safe because the lag in heat transfer would be sufficient to prevent the crystals from going above a safe maximum temperature of 105 F.

The drawing above shows how we solved the problem, that is, by building a simple countercurrent heat exchanger, using standard stove pipe, the inner pipe for the hot combustion products, the outer for air.

Visit our booth No. 48 at the Exposition of Chemical Industries at Philadelphia December 5-9

FIG. 2453 DG (Sectional)—
150-Pound Stainless Steel
O. S. & Y. Gate Valve.



Performance-- Value...

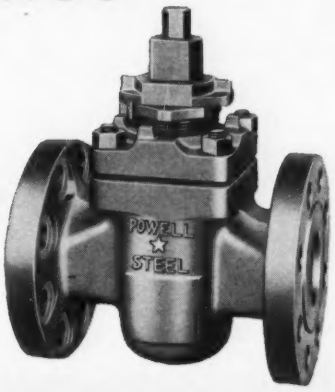
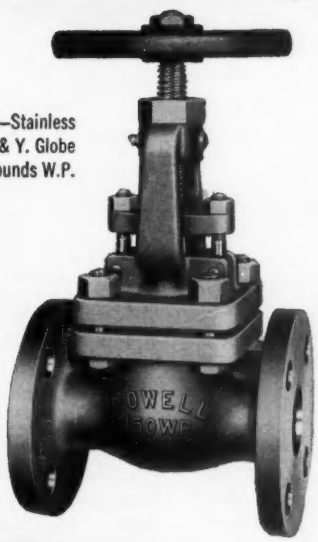


Fig. 1559—150-Pound Steel
Lubricated Plug Valve.

. . . POWELL VALVES . . . THE COMPLETE QUALITY LINE . . . POWELL VALVES . . .

FIG. 2475—Stainless
Steel O. S. & Y. Globe
Valve For 150 Pounds W.P.



Powell Valves

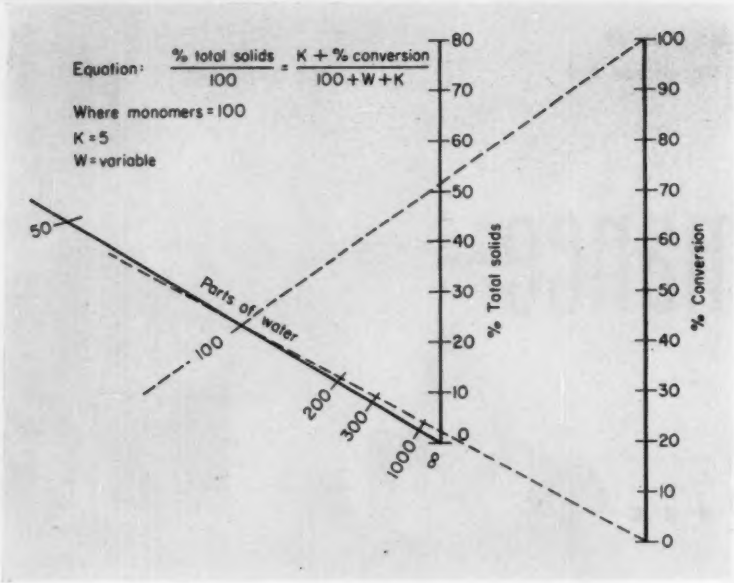
FIG. 2342—Stainless
Steel Bolted Cap Swing
Check Valve For 150
Pounds W.P.

You can depend on outstanding *performance* from every valve made by The Wm. Powell Company, for Powell Valves have a proven record of long life and dependable service.

And Powell Valves give you better *value!* They're precision made and incorporate many quality features—features that can save you money and give you lasting flow control.

Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our *COMPLETE quality line*, and help solve any flow control problem you may have.

The Wm. Powell Company, Cincinnati 22, Ohio . . . . . 109th year



Novel Chart Solves for Four Variables

Phillip I. Johnson

Technical Representative, Naugatuck Chemical, Akron, Ohio.

Nomographs of the type discussed here seem to have been largely neglected by engineers. However, they are extremely useful since they easily solve problems with three independent variables and one dependent variable.

The nomograph has three lines. Two of these lines are brought together to form a V. The point at which the lines meet is zero on one line and infinity on the other. In the accompanying chart, the center and righthand lines have divisions which are of constant size. The third line has divisions which get smaller and smaller as the center line is approached. The method of striking off the third line is described below.

Actual positions and values can be varied widely to properly cover the conditions prevailing. A section of the nomograph can be "blown up" for greater accuracy.

The graph shown has been used in a pilot plant to control the emulsion polymerization of a certain resin. In a typical run, the progress of the reaction is followed by evaporating water and unreacted monomer from samples and obtaining values of "total solids." These values of total solids are then used to calculate percentage conversion by the following formula:

$$\frac{\%\text{ total solids}}{100} = \frac{K + \%\text{ conversion}}{100 + W + K}$$

where W = parts of water; K = parts of initial solids, such as catalyst and soap; and the formula is always based on 100 parts of monomer.

In the graph, the middle line represents Percentage Total Solids; the right line represents Percentage Conversion. The line going off to the left at an angle represents Parts of Water. For the simple case where K equals zero, the W line is merely an extension of the line between the zero points of the two vertical lines. Then actual values of W are easily plotted by solving the above equation for one value, such as 100% conversion. As in other nomographs, the three values of water, % solids, and % conversion lie along a straight-edge placed on the paper.

When K is some value other than zero, the W line will start at the same point (zero on the % total solids line) but will swing slightly above the line where K equals zero. The actual case shown is one where initial solids of soap, catalyst, etc., add up to five parts (monomers=100 parts). The point representing 100 parts of water was plotted by solving the equation twice, once for 0.0% conversion, and then for 100% conversion. This point established the slope of the W line, and this line was drawn. Then successive values of W (50, 200, 300, and 1,000) were plotted by solving the equation for % total solids at 100% conversion.

The graph is most valuable when a number of runs are being made with formulas using varying amounts of water, catalyst, soap, and other solids.

Plots of this type can also be used to solve other problems. For example, I have used it to study the effect on prices when one or more variable cost components are changed. Other uses easily suggest themselves.

Quickie Ideas for the Maintenance Man

Paul C. Ziemke

Safety Engineer, Oak Ridge, Tenn.

Here are a couple of ideas worth a million to the man who really needs them. And one of them you may want to use also in your home workshop.

If you need an anti-galling agent for high-temperature threads on autoclave bolts, try milk of magnesia. The hotter the bolt, the more slippery and oily it becomes. After years of grief we hit on this by accident.

Next time your shop has a lot of thin-walled metal tubing to cut, make a three-piece wooden miter box, then put two fine-toothed hack saw blades in the saw frame, with teeth facing in opposite directions. This doubles cutting speed and never allows the work to bind or tear.

Which of these 22 tube steels will give you maximum tube life per dollar? *Ask the experts!*

This month's report is on: **2% CR.-MO.**

Has intermediate corrosion resistance in combination with good creep strength and fair resistance to oxidation. For use at temperatures up to 1200° F. in cracking coils, reforming units, heat exchangers, vapor line and hot oil piping, and return-bend forgings for oil heaters.

ONE OF 24 TIMKEN HIGH TEMPERATURE STEELS

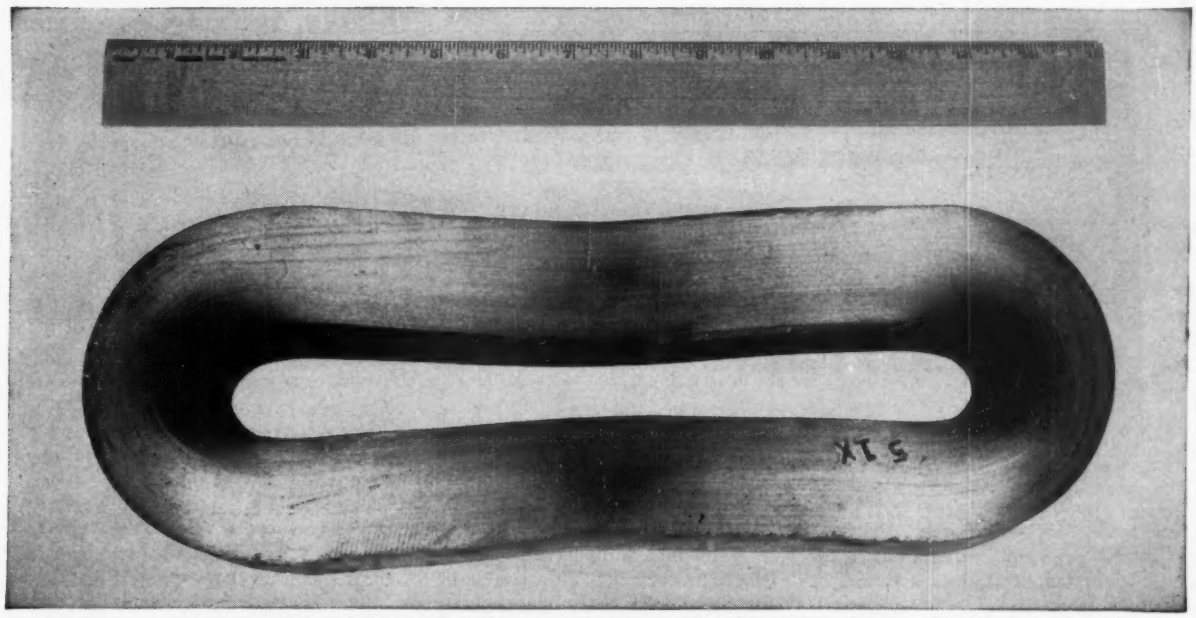
Carbon	Sicromo 2	Sicromo 5S	18-8 Ti
Carbon-Mo.	Sicromo 2½	Sicromo 5MS	16-13-3
DM-2	2½% Cr.-1% Mo.	Sicromo 7	25-20*
Silmo	Sicromo 3	Sicromo 9M	25-12*
DM	4-6% Cr.-Mo.	18-8 Stainless	35-15**
2% Cr.-Mo.	4-6% Cr.-Mo.-Ti.	18-8 Cb	16-25-6**

** Available as seamless tubing on an experimental basis only.*
***Not available as seamless tubing.*

FOR every high temperature application, there's one tube steel that gives you the best life-cost ratio. One steel best answers your particular set of temperature-pressure-corrosion-oxidation conditions. That's why the Timken Company makes the 24 different high temperature steels shown in the box at left.

To find the one best steel for each of your applications, ask the Timken Company metallurgists. They're experts. They know how to balance the various factors against cost—and recommend the analysis that gives you maximum tube life per dollar of cost. They've been doing it for 20 years. And remember—regardless of analysis, you get uniform quality in every Timken® tube because we rigidly control quality at every step from melt shop through final inspection.

Put our "RSQ"—Research, Supply, Quality—to work on *your* tube problems. *Ask the experts!* The Timken Roller Bearing Company, Steel & Tube Division, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".



Flattened test of 10½" O.D. by 1.580" wall of 18-8 Cb showing the excellent ductility of large, heavy-wall Timken seamless tubing.

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

These 6 advantages recommend glass for your most severe chemical handling services

1. Glass does not rust . . . It's unaffected by all acidic solutions and acids except hydrofluoric.

2. Glass is noncontaminating . . . The exceptional chemical stability of PYREX brand glass equipment assures product purity.

3. Glass is transparent . . . You see what's happening as it happens. You have an immediate visual check on conditions inside the equipment.

4. Glass is easy to clean . . . Its hard, smooth surface resists the build-up of even sticky materials.

5. Glass is strong . . . PYREX brand glass No. 7740, used for pipe, heat exchangers, towers, fractionating columns, has great resistance to both physical and thermal shock.

6. Glass is economical . . . Installation is simple. Maintenance is negligible. You will find the initial and maintenance costs of PYREX equipment low.

And this is the PYREX brand glass equipment that lets you corrosionproof entire processes for:

Fluid transfer Fractionating Heat exchanging

The PYREX *brand glass shell and tube heat exchanger* is available in two sizes. The one illustrated here has a capacity of 50 sq. ft., and weighs only 165 lbs. dry. The capacity of the smaller size is 13½ sq. ft. It weighs 45 lbs. dry. Multiple units can be connected in series or parallel to match the volume of liquids you need to handle.

PYREX brand glass shell and tube heat exchanger gives complete corrosion protection

If your heat exchangers handle fluids that eat the heart out of metals or other materials . . . or chemicals sensitive to metallic contamination . . . or liquids that quickly foul the tubes . . . this *nonmetallic shell and tube heat exchanger* will give you relief from costly problems.

Nothing to corrode–This new *shell and tube heat exchanger* has no internal, exposed metallic parts. Liquid comes in contact only with PYREX brand glass No. 7740, chemically resistant ceramic and Teflon–on either the shell side or the tube side. It is proof against all corrosive fluids, except hydrofluoric acid, hot concentrated phosphoric acid, or concentrated alkalies.

Light tube walls have a high conductivity coefficient ($h = 260$ b.t.u./hr./ft.^{2}/deg. F.) for high operating efficiency. Efficiency stays high because freedom from deposits prevents fouling or heat-insulating the tube surfaces with layers of scale.

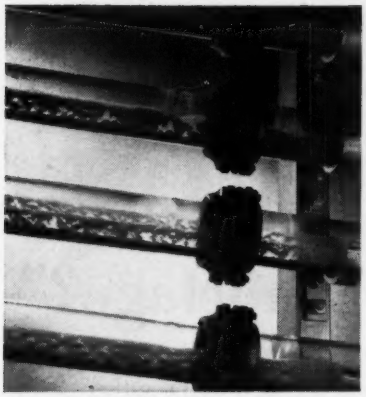
You can use this efficient new production unit for cooling, condensing, heat exchanging, refluxing or partial condensing.

Compact – A 50 sq. ft. unit requires only 9″ x 13′ of floor space and just 13″ of height. Stack units vertically in series or parallel without additional floor space.

Cleaning problems disappear – Smooth, hard glass is easy to clean and you can see when cleaning is needed–and when it's complete. You can clean the PYREX brand shell and tube heat exchanger with hot mineral acids.

Economical – You end corrosion's toll, reduce cleaning costs, avoid long operating delays for maintenance or replacement. If you have sea or river water at hand you can lower coolant costs. Two men, without special equipment, can handle installation.

The PYREX *brand "corrosionproof" shell and tube heat exchanger* is already serving many chemical processors, handling with ease chemicals that used to raise costly corrosion problems. You can learn all about this new unit in Corning technical information. Write, wire or phone.



The principal advantage of PYREX brand "Double-Tough" glass pipe is its great chemical stability, its outstanding resistance to corrosion.

PYREX brand glass pipe

With PYREX *brand "Double-Tough" glass pipe* you can safely handle fluids that are serious corrosion problems in pipe of other kinds. Such acids as sulphuric, hydrochloric, nitric, acetic; such materials as chlorinated hydrocarbons, hydrogen peroxide, bromine, brines, and low-concentration alkaline solutions.

You'll end clogged-line headaches, too, with PYREX pipe. The hard, smooth glass surface resists build-up. Sludge gets no grip. Glass pipe cleans easily and, because it's transparent, you can see when it needs cleaning and when cleaning is complete.

You can get PYREX pipe in I.D.'s from 1″ to 6″ and in any length up to 10 feet, with fittings for even the most complex layouts. More than 75% of the PYREX pipe now in use has been installed by our customers' own pipe fitters.

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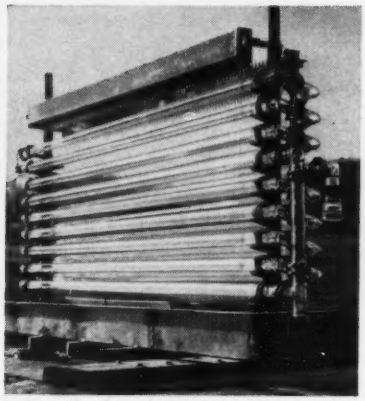

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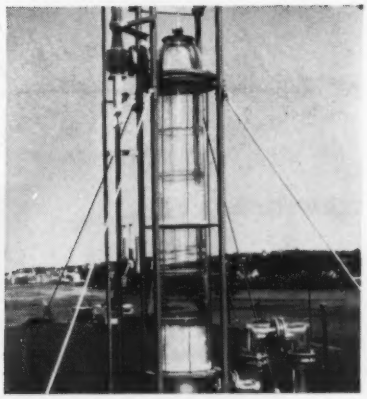

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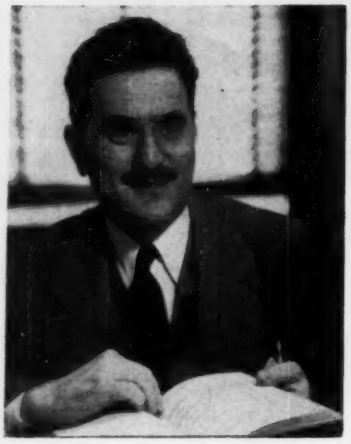

What Do They Mean— "Engineer Shortage?"

"We emphasize the gathering of new data rather than their critical review and evaluation. So it isn't surprising that special interest groups can prove anything they want to." So writes this noted economist and manpower expert.

He then offers some searching questions that will help you make a more acute evaluation of the mass of figures, facts and opinions that tumble at you from so many sources.

Eli Ginzberg, Columbia University

RIGHT from the beginning, I would like to direct this discussion to the broad subject of highly trained manpower for every facet of our society—rather than limit myself to the more confining context of scientific and engineering manpower.

I feel that it is a fundamental error to isolate one type of such personnel and treat it alone. Obviously, the engineer and the scientist come from the same stream as the doctor or the lawyer. In a democratic society, where individuals have freedom of occupational choice, this fundamental consideration takes on heightened meaning.

Probably through the intensive activities of the engineering societies and large companies which employ engineers, this field has been taking a bigger bite of the supply of individuals inclined to a scientific career. But other fields have had to pay the price. Deans of medical schools, for example, bemoan the steady drop in the number of able applicants.

ELI GINZBERG *is professor of economics in Columbia Graduate School of Business. He also serves as director of research for the National Manpower Council and has advised top government officials on manpower policies. This article is an adaptation of a talk which Mr. Ginzberg gave to a group of McGraw-Hill editors.*

No Room for Gadgets

If we are not to rob Peter to pay Paul, we must increase the total number of potential professional people at the earlier stages of the educational cycle.

A gadgeteering approach cannot do this. To succeed, we would have to alter nothing less than the most basic aspects of our society, for children absorb their attitudes towards life and work at home.

We must also consider the impact of our elementary and secondary schools on developing both the interests and the capabilities of young people. And important, too, is the ease or difficulty with which able high school graduates can finance collegiate studies.

Four Other Problems to Face

Aside from the question of increasing the supply, which other problems connected with our scientific and engineering manpower have we begun to recognize? Actually, there are four—all closely related to the central problem of "shortage."

- Fear that the Russians outproduce us in terms of the number of graduate engineers and scientists.
- Conviction that the Armed Services waste scientific and professional manpower.
- Recognition that an inadequate supply of properly trained engineers and scientists may reflect serious weaknesses in our secondary schooling, particularly in the teaching of mathematics and science.
- Awareness (at least by some) of the possible impact of the mishandling of our security program on the occupational objectives of today's young people.

What Do We Really Know

What in fact do we know about the central question of a scientific manpower shortage? The quantitative approach usually taken can mislead. We talk about a current supply of 600,000 engineers and 20,000 physicists. The sophisticated critic will soon ask whether a man with a bachelor's degree in physics should really be counted as a physicist. If we use a Ph.D. degree or its equivalent as a qualifying criterion, the figure shrinks from 20,000 to 5,000.

Many well-meaning people are distressed by the fact that we have only about 200,000 physicians and that the ratio of physicians to population has not increased significantly in many decades. Yet they pay no attention to the many groups of

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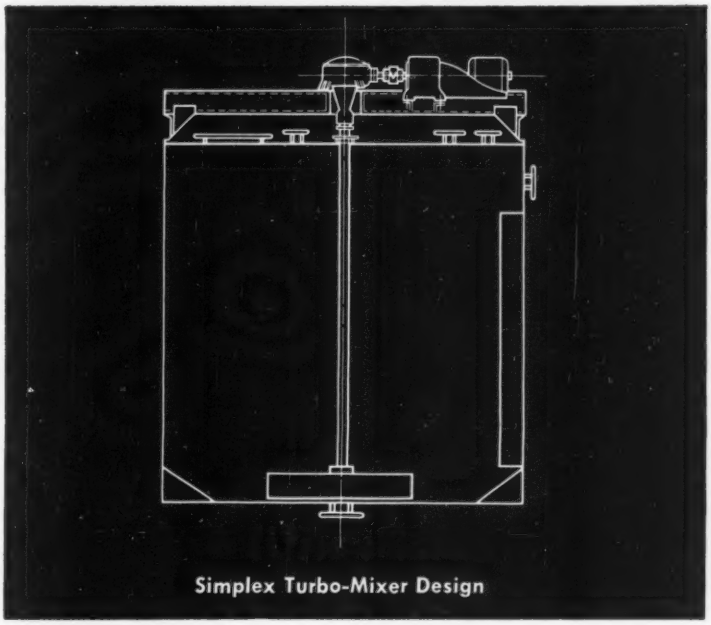

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Quoting Ginzberg

"It makes no sense for industry to spend hundreds of millions of dollars on research and not a penny on how to understand the factors which control the numbers and quality of their researchers."

"It is not easy to encourage young men to deepen their training when good jobs and attractive fiancees are waiting for them."

"Granted, that military intelligence must keep a careful check on present and potential strength of possible opponents. But this is a different matter from deciding that we should revamp our educational institutions because the Russians produce X number of engineers, Y number of scientists and Z number of technicians."

"There are few veterans of World War II and still fewer members of their families who are not convinced that the Armed Services waste everything, especially people."

semi-professional personnel directly involved in providing medical services—groups that have grown very rapidly over the past decades. In short, looking at doctors alone fails to tell the story of whether we have adequate or inadequate medical manpower resources.

Let's look closer at the dangers of a quantitative approach. How many physicists equal one Einstein? A Ford station wagon is a Ford station wagon, but one physicist is not the same as another. The same holds for the much larger group of engineers. How many out of the 600,000 actually can do any type of creative engineering? To compound the matter further, if the national need is for engineers with a specific knowledge of, say, nuclear problems, what advantage is there to trying to bolster the number of civil engineers, especially if few, if any, can convert from civil to nuclear engineering?

To pursue the quality aspect still further, we note that the British and the Germans have always contributed a large number of Nobel prize winners, although in neither country has there been much concern with mass production of engineers and scientists.

Age and Mobility Count, Too

It seems pointless to consider our manpower resources without reference to the age distribution of the individuals within the field. Einstein said some very moving things, probably largely autobiographical, about the inability of even brilliant physicists to be creative after the age of 40, surely 50.

In all of the current excitement about the engineer shortage, the emphasis is not on the engineer but on the young engineer. The reason is clear. Industry knows that most of its older engineers do not have a flair for creative work. They want more young engineers to increase their chance of getting a few who are creative.

Mobility forms another aspect of the problem. From one point of view scientists and engineers are very mobile. From another, they are very immobile. Although you might get an M.I.T. professor out to Los Alamos for two or three years, it may be next to impossible to get him for two or three years in Washington.

Some time ago I served on a review board to appraise an important military research and development group. I think it was clear to all on the board that the government was losing untold millions of dollars a year because of poor management resulting directly from a lack of highly competent research people in the top civilian and military jobs. When good men were available they seldom stayed for more than a year or two.

Take a Closer Look

Let's consider the concept of shortages more closely. If we do have shortages, how did they arise? Six years ago, few people talked about a scientific or engineering manpower shortage. However, starting in 1950 the government and private industry both stepped up very considerably their spending for research and development.

In the case of private industry, even in a company as large as Du Pont or General Electric, strong forces usually prevent unbalanced expansion in research and development. Money is appropriated only after checking on the availability of men and facilities, and weighing the probable gains from the new against the obsolescent costs of the old. However, there are no comparable controls built into the actions of the federal government.

Just think what would happen if Congress suddenly decided to appropriate $4 billion rather than $2 billion annually for research and development. Or what would happen to our "shortages" if there were a cut-back of $500 million.

Now, Let's Look at the Demand

We have already seen that it isn't easy to quantify the supply of engineers meaningfully when one introduces such factors as fields of specialization, age, creative potential. Let us look for a moment at the demand side.

Increasingly, industry prefers general management men with an engineering degree. Of every hundred young engineers who enter in-

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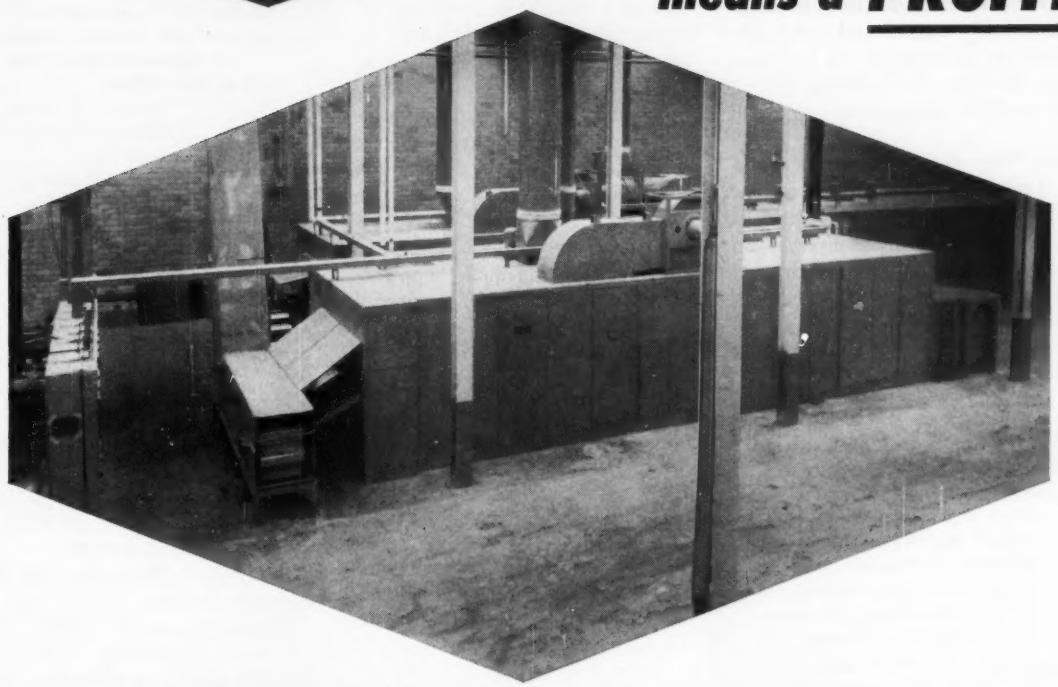

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dustry today, 40 may move into general management within the next five to ten years. Another 40 may actually slip down in effect into the ranks of draftsmen and engineering aides. Some 20 may continue as professional engineers.

Obviously, I make no claims for the validity of these proportions, but I do want to stress the different directions in which engineers move after they graduate. If this is the pattern, then there can never be much point in seeking to expand the total supply of engineering graduates to meet a specific demand for professional engineers.

But What About Russia

I greatly dislike basing discussions of such fundamental problems as the proper use of brainpower on quantitative comparisons with what the Russians are doing. Granted, that military intelligence must keep a careful check upon present and potential strength of possible major opponents. That is, we need to know the state of Russian airpower in order to determine our vulnerability to sudden attack. But this is a different matter from deciding that we should revamp our educational institutions because the Russians produce X number of engineers, Y number of scientists and Z number of technicians.

> **"We are told that Russia turns out 52,000 engineers each year. We are not apprised of the source of this information. However, if this country has an intelligence system which is so effective that it has accurate and intimate knowledge of the numbers and quality of Russian technicians, when, at the same time, no one in this country knows how many we have, then perhaps that intelligence force should be assigned to work at home and produce information of the same degree of accuracy on this subject."**
>
> Joseph Amann
> President
> Engineers & Scientists of America

We have just showed that we can make little sense out of what is happening in the United States if we concentrated solely on quantitative manpower estimates. And no one has yet claimed that the figures on the Russian output of scientific and engineering manpower are superior to our own.

A further reason why I distrust indiscriminate use of Russian example can be illustrated by the trap that Rep. Hinshaw (R. Calif.) recently fell into. Mr. Hinshaw introduced a bill aimed at protecting scientific manpower from misuse in our Armed Services, the preamble to which emphasized that the United States should take a lead from Russia on how to treat scientists and engineers. It has been my impression that we were interested in insuring an adequate supply of scientists and engineers because of the mortal fear of being overwhelmed by the barbarism of communism. And now we have a member of the Congress of the United States holding Russia up as a model for us.

Although I place little faith in such comparative data as I have seen, I am perfectly willing to assume that the Russians have made and will continue to make a strenuous effort to overcome the West's advantage in trained manpower.

Wasting Men and Whipping Boys

Still another aspect of current discussions focuses on the perennial waste of professional manpower by the Armed Services. The Armed Services are now firmly established as a whipping boy in the United States. There are few veterans of World War II and still fewer members of their families who are not ready to jump to the conclusion that the Armed Services waste everything, especially people.

Certain special interest groups aid and abet this attitude in the hope that if they could reduce by public pressure the requirements of the Armed Forces for particular types of personnel, fewer of their members would be forced to serve. I don't imply that the Armed Services are above reproach—far from it—but I question the blithe assumption that they squander trained personnel to the danger of the nation.

It seems to me that the end of our society is something different from the reduction of waste in the use of even such scarce categories of personnel as scientists and engineers. Other values are also involved when men are compelled to serve their country. Moreover the word "waste" deserves a moment's consideration. First, it is important to remember that young men with bachelor's degrees in engineering are not necessarily very valuable manpower resources. Many have acquired their degrees in weak schools, and at graduation their capacity to make distinguished contributions to the economy or society is, at best, limited.

> **"In a sense we are losing two full years of the production of engineers and scientists because they are required to spend these years in the military."**
>
> Maynard M. Boring
> Manpower Consultant
> General Electric Co.

In addition, the young man who serves in the Army is not necessarily going to develop more slowly than he would at drafting bench in a large industrial corporation. One need not be very cynical to point out that a study of the use of engineers by industry might uncover something less than 100% effectiveness.

A Byproduct Turns Major Gain

One of the major gains that has accrued to the American public as a byproduct of its concern with manpower shortages is the reconsideration of the make-up and methods of its educational institutions. We've begun to recognize that gross increases in the numbers attending and graduating from elementary and high school can be very misleading. More important are the answers to such questions as what the students learn while in school and what happens to the best students along the line.

In this connection it is well to

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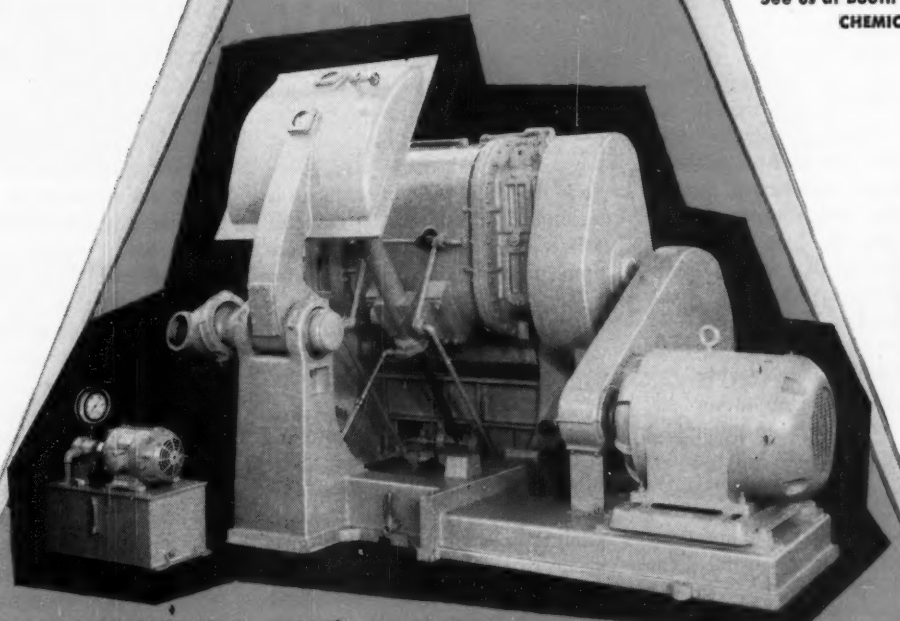

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note that in one of our Southern states no mathematics is taught at one-quarter of the high schools. In many of the smaller high schools in the Southeastern states it is customary for the football coach to teach science—a man's subject.

Along another tack we find that only about half of our most capable students ever enter college, and only 40% of these graduate. I do not want to argue in favor of all bright

> **"Our whole primary and secondary education for many years has been oriented primarily in the direction of minimizing, to a fair degree, the number of scientists and prospective scientists coming through our schools."**
>
> John R. Dunning
> Dean
> Columbia School of Engineering

people going to college—some might do better elsewhere—but these figures do suggest that we're wasting much of our potential.

I am particularly distressed about what goes on at the post-graduate level. One of the more insidious consequences of our widespread prosperity is the fact that at the end of their college courses bright young men can secure positions paying them $500 a month, thereby discouraging their continuing with graduate studies. This is strengthened by the fact that we are rapidly approaching in this country the Asiatic pattern of child marriages.

Security Can Double Trouble

To further compound our difficulties, we have been enmeshed these past several years in seeking to develop an appropriate security system. Clearly, our success has been something less than spectacular. In fact, it forms a major detriment to the progress of science and to increasing the numbers of young men entering upon a scientific career.

It is worth considering the proposition that our Nation might have had greater security if we had never embarked on our present security program, but had restricted ourselves to basic types of protective action. We appear to have taken over into science the security concepts that we require for operational warfare. No wonder we are in trouble.

How Can We Learn More

Our next broad question is how can we learn more about the subject of scientific manpower resources. The difficulty that we face is that economics developed almost entirely as a study of commodity trade, its concepts are useable only to a limited degree in the analysis of human resources. At the outset, I mentioned the fact that it is not possible to focus on any single type of manpower; it's always necessary to relate those in a particular category at least to others who work in close association.

To illustrate: Shortly after the Korean War, the Army estimated that it required 900 more engineers for the next fiscal year. Closer inspection revealed that the actual need totaled about 10 additional engineers and 890 technicians and draftsmen. Incidentally, some of our largest corporations make the same type of miscalculation.

Not only is it necessary to study manpower problems within the broad framework of our total resources, but we must also relate these to other resources such as technology and capital. We like to believe that we can solve every problem with money. Unfortunately, in the realm of ideas this is not true. In fact, the indiscriminate spending of money may retard rather than speed progress.

Incentives, Rewards and Training

The conspicuous fact about scientific and engineering manpower is the long time period required to produce a trained person. This means that it is necessary to explore the way in which the environment in which young people grow up contributes to or detracts from their ability and inclination to put forth the effort to become professional persons.

The question of incentives and rewards is paramount. In my own field, I advise no student to contemplate an academic career unless he comes from a very modest background and has modest consumption goals or unless he succeeds in marrying a wealthy girl. In the absence of one of these two alternatives he will be in deep and continuing conflict between the fulfillment of his talent and his responsibilities to his family.

The level to which we train our professional persons is another important consideration. Some leaders of engineering education have stressed for some time the major gains of adding a fifth year to the basic program. If engineers were more adept in basic mathematics and physics, we could undoubtedly get on with a smaller total number.

It is not easy to encourage young men to deepen their training when good jobs and attractive fiancees await them. Great Britain and Germany have never trained proportionately the numbers that we have, but they have made a greater investment in those educated.

You Can Prove Anything

One of our outstanding characteristics is the production of large bodies of statistical data. We emphasize the gathering of new data rather than their critical review and evaluation. So it isn't surprising that special interest groups can prove almost anything they want to. Since, by definition, the interest group has a greater concern with its problems than the public at large, the odds are that its particular interpretation will be accepted.

Engineering societies have been insisting that the country is in jeopardy because of the decline in the number of engineering graduates since 1950. The man in the street is seldom told that 1950 was an exceptional year because it represented the high point in postwar graduations; nor that we now have fewer young men coming of age because of the low birth rate of a generation ago, but that the time has come when this is on the upgrade again.

Areas Worth Exploring

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that we gain a deeper knowledge of this important problem.

Since most people assume that we have been suffering from serious shortages in manpower resources since the outbreak of hostilities in Korea, it would be well to review and assess the consequences which have resulted from these shortages—if they exist.

Since we now make a major effort to cajole greater numbers of young men into engineering schools, it might be well to review the experience of World War II when, under the Army Specialized Training Program, large numbers of young men were directed into engineering curricula.

Since such a large part of the total demand for scientific and engineering manpower is a direct outgrowth of our defense program, some critical studies of the way in which this program is managed—from the highest echelons in the Pentagon to the actual development

> **"A sizable number of firms (surveyed by us) said they had been forced to curtail projected increases in their research and development programs because of the lack of qualified personnel."**
>
> Alan T. Waterman
> Director
> National Science Foundation

unit working in the field on a cost plus basis—might shed some important new light.

We agree on the crucial role of the high school in determining the supply from which must come all of the trained manpower of the country. It would be well to undertake some regional analyses to understand what lies behind the fact that Utah sends almost 60% of its 18-year-olds to college, while South Carolina sends about 10%. The special problem of the Negro explains part of the difference, but only a part.

If it is true, as a few students of the problem believe, that the demand for engineers has become more or less insatiable because of the flow of engineers from technical work into general management, it would be desirable to follow the careers of representative samples

> **"In 1955, there are probably somewhere in excess of 5,000 scientist and engineers working on atomic problems, some 400 having received formal training in the field and over 4,000 having been brought into this field through retraining on the job."**
>
> Louis H. Roddis, Jr.
> Deputy Director
> Division of Reactor Development
> U. S. Atomic Energy Commission

of the graduating classes of ten and twenty years ago.

One of the most challenging questions would be to discover how manpower resources become available in a new field such as nuclear engineering. Initially no one was trained specifically for this field. Where did the manpower come from—and what can we learn about flexibility and versatility, from a study of this question?

One final suggestion: It is difficult to overlook the fact that during these past years when so many have been talking so loudly about the severe shortage of engineers, there's been relatively little evidence of major efforts to insure the more effective use of highly trained manpower by increasing the number of supporting personnel or by making other adjustments.

What Has to Be Done First

The foregoing specific suggestions, and they could be multiplied many times over, can be summarized very simply. We must face up to the fact that manpower is a complicated subject and that if we are to learn how to deal with it critically, we need to improve our theory and our techniques of analysis. In short, it makes no sense for industry to spend hundreds of millions of dollars on chemical research and not a penny on how to understand the factors which control the numbers and quality of chemists and chemical engineers in the country.

Secondly, we need to insure that scientific research in manpower be university based, for it cannot develop its true potentialities as a handmaiden of special interest groups. And finally, all concerned must recognize that altering the supply and quality of our manpower resources is not a question of a public relations campaign or even of a series of salary adjustments, but rather it involves basic alterations in many facets of our social structure, including the home, the school, and many of the values of the society at large.

If we accept the fact, as I think we must, that the human resource factor is the key determinant of our national security and our economic progress, then we must also accept the fact that the time has long since passed for us to begin to devote more effort to understanding this factor. If we do so, there is every reason to believe that we can thereby enhance both our wealth and our security.

Watch for These Features in Future Issues

Getting ahead is simply a matter of developing and sharpening the "slight edge" that makes you just a bit better than the next fellow. That's the opinion which Auren Uris, noted author and editor for the Research Institute of America, advances in his about-to-be-published book, "Developing Your Executive Skills." We'll discuss his down-to-earth approach and the practical, up-to-the-minute techniques he offers next month.

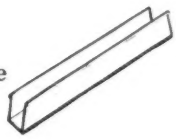
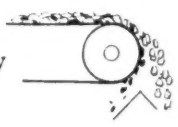
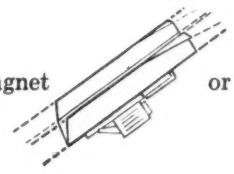
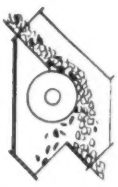
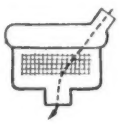
Job outlook for chemical engineers in 1956 seems pretty good at this distance. But January's You & Your Job will pilot you in for a much closer look. You'll get a preview glimpse of the job situation for each age group and work category, plus a peek at the salary outlook. The effect of engineer union drives, the opening of new job areas to chemical engineers, possible draft and reserve calls, etc., will also be scrutinized.

Product purification has many magnetic answers

You want a clean pure product free from dangerous tramp iron You need a magnetic separator to remove this iron contamination.

But what kind of magnet? First you contact a Stearns Magnetic engineer

He checks your product; granular or powder chunks

liquid ; the kind of tramp iron, such as mixed scrap or tiny iron particles ; the kind of conveyor like belt chute  or pipe Based on these and many other factors, he might recommend a magnetic pulley  or a spout magnet  or a magnetic drum  or suspended magnet or multiple stage cross belt ; or if the product is liquid, a magnetic filter  or a pipe trap magnet

Stearns Magnetic, Inc. builds all these plus other highly specialized magnetic separators, electro or permanent, either in standard models or custom-built to your exact needs. We will be happy to send you literature on any of the separators mentioned above — or answer specific questions on tramp iron removal or product purification. Complete laboratory facilities available for testing materials. Write, wire or call us or see your Stearns Representative.

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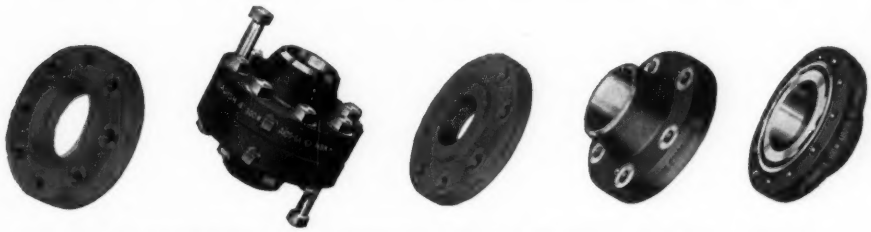

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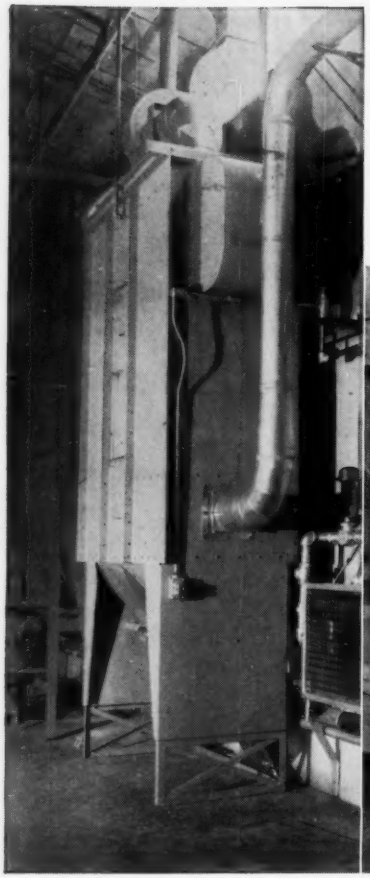
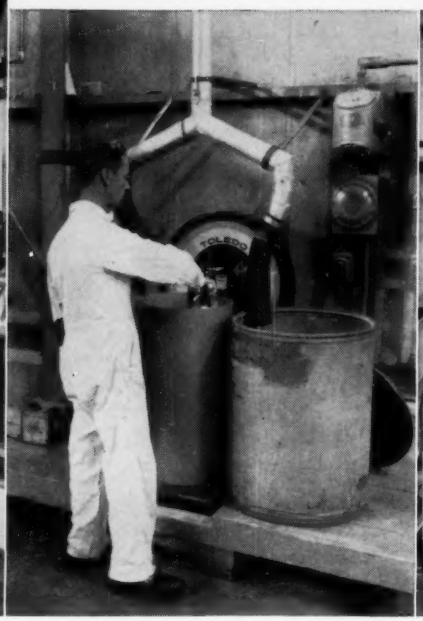
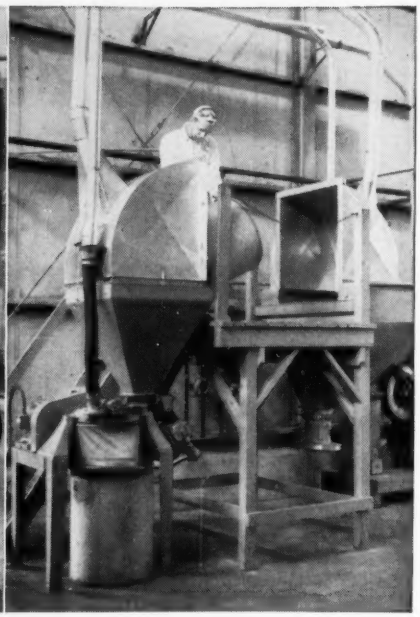


HOW NORWICH PHARMACAL CO.

STOPS PRODUCT LOSS





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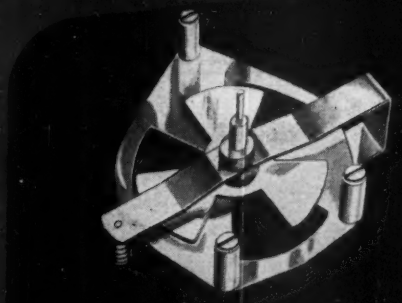

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this potentiometer has no slidewire

STEPLESS CAPACITY-BALANCING PROVIDES SPEED WITHOUT WEAR!

Friction-free balancing action! That's why Dynalog responds almost instantly to the slightest changes in a process variable . . . without wear . . . with *lasting* high accuracy.

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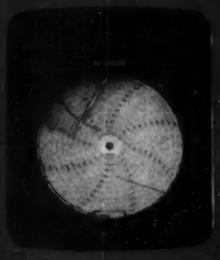

DYNALOG's* EXCLUSIVE BALANCING ACTION

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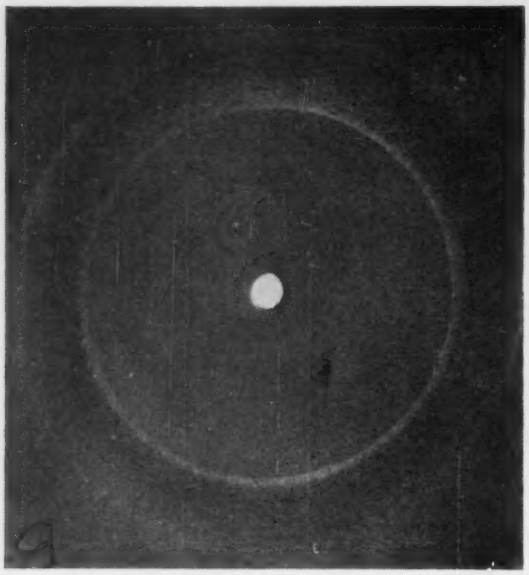
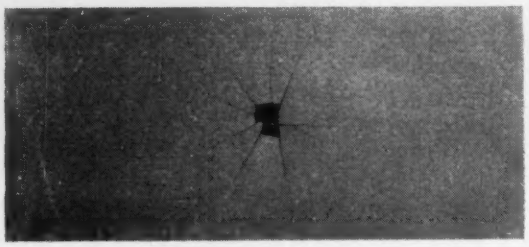
DYNALOG ELECTRONIC INSTRUMENTS



ABRASION RESISTANCE—Circle shows path of abrasive wheels on coating.

ADHESION—Coating tends to flake where scribe marks are close together.



IMPACT RESISTANCE—Result of reverse impact test on coated panel.

Evaluating Physical Properties of Coatings

Chemical resistance alone is not enough—a coating must also meet standards of permeability, thickness, adhesion, flexibility, and abrasion.

J. I. Richardson, Amercoat Corp.

A coating which is to offer dependable protection against corrosion must meet two general requirements:

1. It must be resistant to the environment.

2. It must serve as a barrier between the environment and the underlying surface.

The distinction between these two properties is often overlooked. One might expect that a resistant material would automatically serve as an effective barrier, but unfortunately this is not always true. For example, a concrete wall— especially in a basement—often allows water to seep through. The concrete itself is unharmed by the water, but it is not an effective barrier against it. Likewise, many coating materials are water resistant and chemically resistant, yet fail as protective coatings because of permeability or other discontinuties. Even though a coating may be resistant in itself, it is of no value if it is so permeable that the corrosive agents in the environment can pass through the protective film and react with the underlying surface.

The first requirement, resistance to the external environment, can to a large degree be evaluated by chemical tests. Effectiveness as a barrier depends upon several properties, most of which can be evaluated by physical tests. Most important of these properties are permeability, thickness, adhesion, flexibility, and abrasion resistance.

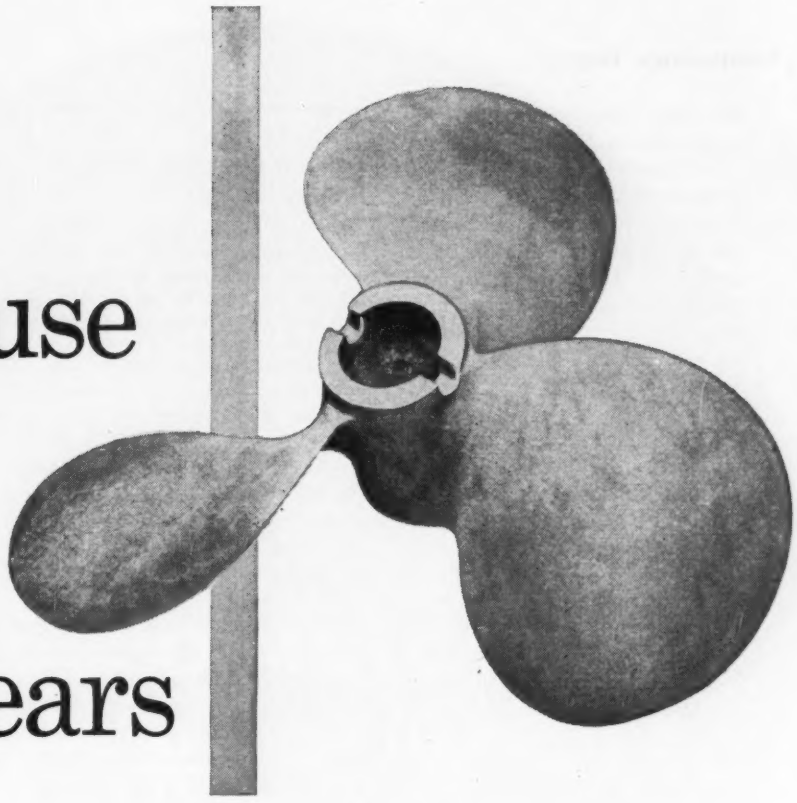
J. I. Richardson *is technical director of Amercoat Corp., South Gate, Calif.*

Permeability

All film-forming materials are to some extent permeable. That is, gases or vapors can migrate slowly through the film without disrupting it. However, the inherent permeability of different film-forming materials varies as much as one hundredfold, and it can be influenced even further by the coating formulation. Since the protective value of the film depends to a large extent on its ability to prevent passage of corrosive materials, it is vitally important in coating evaluation to select the least permeable material available.

Though film-forming materials usually show different rates of permeability to various specific vapors and gases, the permeability to water vapor usually gives a reliable indication of their performance. Permeability is usually expressed as the rate at which water vapor will migrate through the

Still in use after 4 years



in hot sulphuric acid and chlorides

PROBLEM.... Agitator propellors were failing at a rate of one every three months in dye kettles where hot sulphuric acid was mixed with chlorine-bearing organic chemicals. Sometimes corrosion was so severe that the propellors fell off the shaft and chipped the kettle lining. This required a major overhaul.

REMEDY..... Agitator shaft and propellor made of HASTELLOY alloy D were installed.

RESULT..... Four years later the same propellor and shaft made of HASTELLOY alloy D are still in service.

HASTELLOY alloy D has excellent resistance to sulphuric acid in all concentrations and at temperatures up to the boiling point. In addition, it is resistant to many other acids and salts frequently used in solution with sulphuric acid. For a copy of a booklet describing HASTELLOY alloys, get in touch with the nearest Haynes Stellite Company office.

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film under standard conditions of temperature and vapor pressure.

One method of measuring permeability is described in detail in "Physical and Chemical Examination of Paints, Varnishes, Lacquers and Colors" by Henry A. Gardner. In brief, the method utilizes a small metal cup fitted so that a film of the material to be tested can be sealed over the top. First, a small amount of water is placed in the cup, the film is sealed across the top, and the whole assembly weighed. Then the cup is placed in a dessicator at constant temperature. After a measured interval of time the cup is again weighed and the results expressed as grams per 100 sq. in. per 24 hr. Thickness of the film is obviously a factor in this determination, and for a practical answer the test should be made on a film of the same thickness which will actually be obtained in a full scale application.

For effective protection, the permeability of the complete coating should ordinarily be not more than 1 gram per 100 sq. in. in 24 hr. at 95 F. with a pressure differential of 42 mm. of mercury.

Thickness

Even though a film may be relatively impermeable, it will be ineffective as a barrier unless it provides a continuous membrane without breaks or pinholes. Many coatings tend to pull away from sharp corners and edges, or fail to bridge over pits and crevices, leaving small areas which are in effect not coated at all.

Thus, coating thickness is of twofold importance. First, increasing the thickness causes a proportionate decrease in permeability. Secondly, thicker films are much more likely to deposit a continuous film over sharp corners, edges, and rough welds. Ordinarily at least 4 to 5 mils thickness is required to produce a continuous protective film over such surfaces. If extremely sharp edges or rough surfaces are encountered, an effective coating should be capable of depositing a film of approximately 10 mils.

Although coating thickness has a great influence on protective value, it must be realized that thickness alone is of no value unless the film is high in chemical resistance and low in permeability. It would be very simple for the formulator to increase the thickness of his coating by adding fillers. However, this ordinarily increases the permeability of a film to such an extent that the advantage of the thickness is lost. Only among coatings of equal density and resistance to permeation are thicker films more dependable.

Any prescribed thickness can be obtained, of course, by applying a sufficient number of coats. But it is obviously an advantage to attain the optimum thickness in as few coats as possible, so a coating is desired which will produce maximum thickness per coat. The thickness per coat of a dried paint film is governed by the percent solids by volume in the packaged paint. If this could be determined analytically, it would instantly show what thickness could be obtained from the coating when applied at a given rate of coverage.

However, analysis of this type is extremely difficult, and it is usually more practical to measure the actual thickness of a dried film. This can be done by uniformly spreading a known volume of the coating over a known area and measuring the final dry film thickness, either with a micrometer or magnetic thickness gauge. The micrometer is more accurate, but its use is limited to panels where an edge is available. The magnetic thickness gauge, of which several types are now available, can be used on nearly any ferrous surface, and gives readings which are usually of sufficient accuracy.

A variation of this method is to measure first the wet film thickness and then the final dry film thickness in the same area. For this purpose there are wet film thickness gauges which penetrate the film and measure with reasonable accuracy the thickness of the coating when it is applied. When used with fast-drying materials, however, the coating must be brushed or flowed on the surface and the wet film thickness measured as quickly as possible to avoid errors due to solvent loss.

Ratio of dry film thickness to wet film thickness gives the volume percent solids in the coating. With this data the thickness for any coverage rate can be calculated.

For example, assume the wet film thickness of a coating is 4 mils and the dry film thickness 1 mil. The volume percent solids is thus 25%. Number of square foot-mils than can be obtained from a gallon of coating material can then be determined by multiplying the percent of solids by 231 (cubic inches in a gallon) times 1,000 (to give the result in thousandths of an inch or mils), and dividing by 144 to determine the number of square foot-mils. Using the 25% solids from the foregoing example, the calculation would then be made as follows:

$$0.25 \times 231 \times 1{,}000/144 = 400 \text{ sq. ft.-mils}$$

Number of square foot-mils divided by the coverage rate gives the thickness in mils. Thus, if the coating is applied at 200 sq. ft. per gallon, the thickness will be $400/200 = 2$ mils.

Knowledge of the solids content is indispensable in coating evaluation, since if other properties are equal, the coating which produces the greatest number of square foot-mils will be the most effective and most economical.

Adhesion

Degree to which adhesion influences coating peformance is of far greater magnitude than is often recognized. Not only must the coating adhere tightly enough to resist physical damage, it must also be sufficiently adherent to prevent

NEXT MONTH:

DUCTILE AUSTENITIC IRONS

See next month's Corrosion Forum for information about the new ductile austenitic irons—which combine the strength and ductility of ductile cast iron with the resistance to corrosion, heat, and metal-to-metal wear of the conventional austenitic iron castings.

Now... your own painter can "COLD-GALVANIZE" any steel surface with DIMETCOTE®

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any PLACE

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any WHERE

SPRAY or BRUSH

Dimetcote is absolutely unique. It is not a paint, it contains no oils, resins or any other organic materials, yet it can be applied by spray or brush. When Dimetcote is applied to steel, a reaction takes place at the surface which produces chemical bonding as well as physical adhesion. It is almost impossible to find the interface between Dimetcote and the steel.

Dimetcote has many unusual characteristics. It shows no visible change after more than ten years exposure to the most severe weather conditions – sun, heat, fresh and salt water. It is insoluble in all solvents and petroleum products. It is highly abrasion resistant, but if abraded through to bare steel, the coating will cathodically inhibit corrosion.

Now tanks and structures can be given the same protection that galvanizing affords, *plus salt water resistance*. Existing structures need not be dismantled and new structures can be coated either before or after erection. *Only one coat* of Dimetcote over a sandblasted surface is required to protect such structures as:

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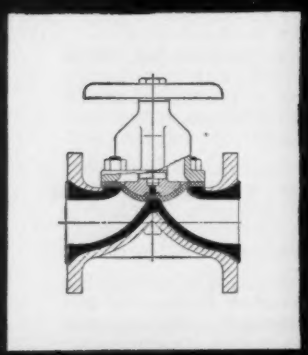
DURCON®

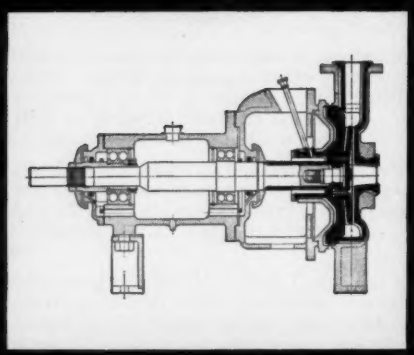
An epoxy resin from which an almost unlimited number of shapes can be produced by a process developed by The Duriron Company, Inc.

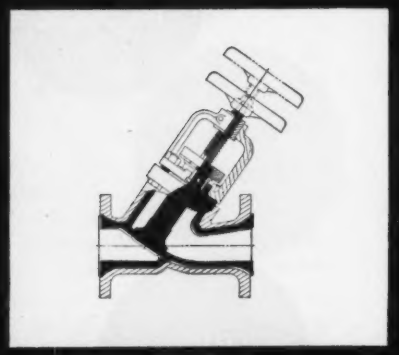
The Duriron Company has produced corrosion resisting alloys and engineered equipment from those alloys for more than 40 years.

Now, with the development of DURCON®, a complete range of corrosion resistant materials is available from this single, reliable source.

DURCON 1 and DURCON 2 are epoxy resins *modified* by an exclusive Durco process to increase corrosion and abrasion resistance. Two years of field tests demonstrate DURCON'S adaptability to organic acids, inorganics, solvents, alkalies and solutions of the halogen salts.







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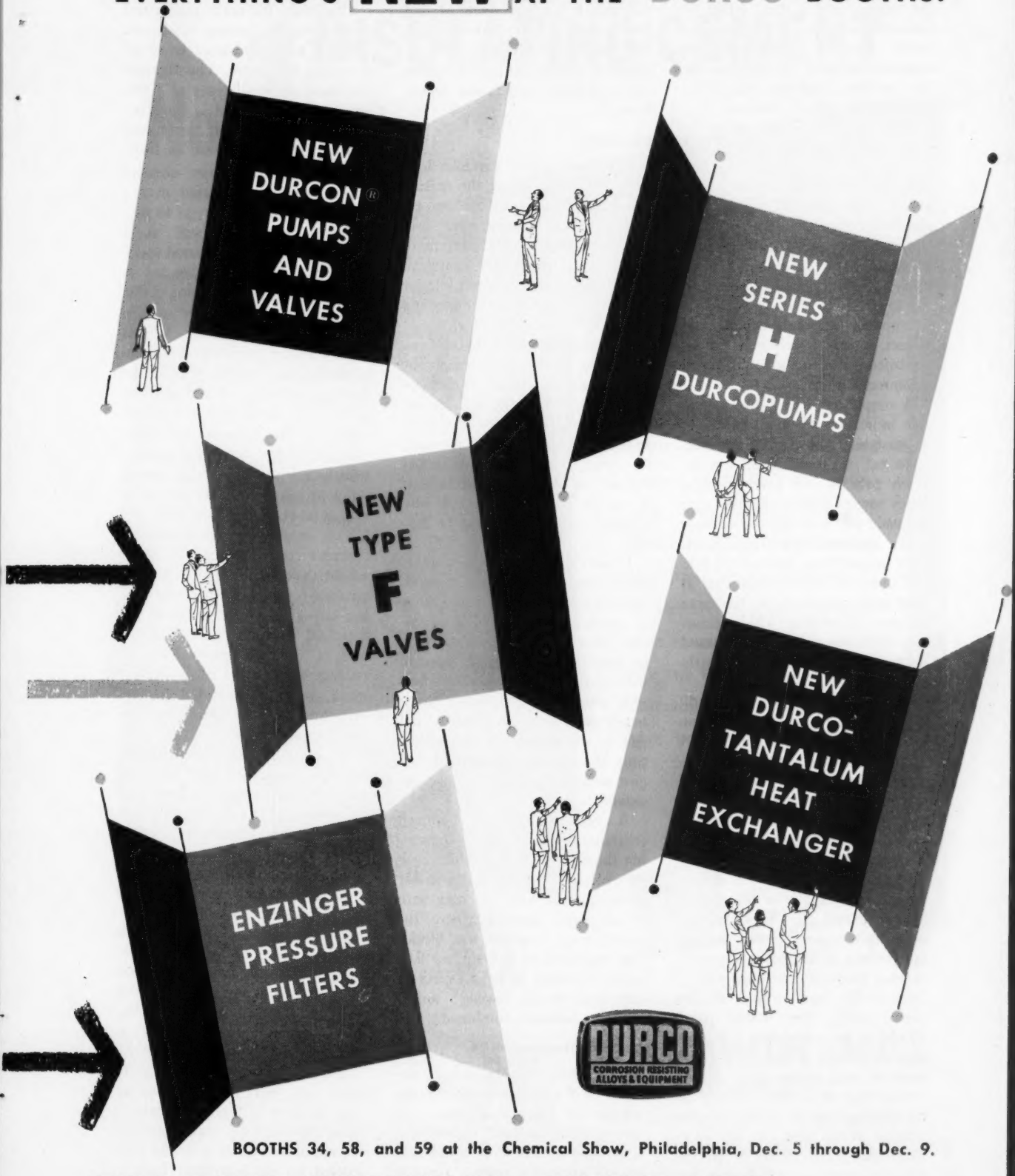


BOOTHS 34, 58, and 59 at the Chemical Show, Philadelphia, Dec. 5 through Dec. 9.

THE DURIRON COMPANY, INC., DAYTON, OHIO

corrosion from progressing beneath the coating—and it must retain its adhesion in a corrosive environment. Thus it is important to measure retention of adhesion under corrosive conditions as well as determining initial adhesion.

Adhesion tests should always be made on a standard surface, so that varying degrees of surface texture will not distort the results. Cold-rolled steel panels are recommended for such tests, since the surface is essentially smooth, thus minimizing the possibility of a puely mechanical bond. The coating to be tested should in all cases be applied over the recommended primer, if any is required, in accordance with the manufacturer's recommendations.

A simple test which gives a reliable indication of initial adhesion, or resistance to mechanical removal, is to cut the coating in a crosshatch pattern and note any tendency toward flaking. Parallel cuts are made with a sharp knife or razor blade, approximately ⅛ in. apart. After several have been scribed in one direction, intersecting cuts at right angles are made in the same manner. A coating with satisfactory adhesion should withstand right-angle cuts ⅛ in. apart without chipping or flaking.

This test, however, gives no indication of the retention of adhesion in a corrosive environment. A simple laboratory test which permits a dependable evaluation of this property is as follows:

Test specimens should be prepared as before, using a cold-rolled steel surface to eliminate any variation in the degree of mechanical bond developed. After the coating is applied and dried in accordance with the manufacturer's recommendations, it should be scored by cutting through the film with a knife in the form of an X on the coated side. This coated panel should be immersed in a 5% solution of sodium hydroxide for one week at room temperature. At the end of this time there should be no peeling or blistering of the coating more than ⅛ in. away from the score. This is an extremely severe test which only the most resistant coating materials will pass. It has been demonstrated that a coating system which meets this test will provide the most dependable protection under aggressively corrosive operating conditions.

Flexibility

It is obvious that extreme flexibility is required where the coating is applied to surfaces which are expected to be bent or dented in service. However, some degree of flexibility is required in nearly all uses so that the coating can tolerate vibration, temperature changes, and "working" of structures.

An accurate indication of flexibility can be obtained simply by bending a coated panel over a mandrel. The size of the mandrel selected should, of course, be related to the degree of flexibility required. A coating is ordinarily satisfactory for use on stationary structures if it can be bent 180° over a 1-in. mandrel without cracking or flaking.

However, a flexibility test alone can be misleading since it gives no indication of a coating's toughness or resistance to impact. It is possible that a coating material can be bent around a small mandrel without difficulty, yet shatter when it is struck a sharp blow. Since nearly every coated surface is subject to sharp blows from time to time, the coating evaluation should give some indication of impact resistance.

A qualitative measure of impact resistance can be made by supporting the ends of a coated panel on two blocks with the coating side down, then striking the back with a ball peen hammer where the panel spans between the blocks. The resistance to chipping or flaking at the point of impact gives an indication of the coating's toughness and adhesion combined.

Abrasion Resistance

Whenever a coating is to be applied to floors, handrails, to the interior of bins or hoppers containing solid material, or where it is exposed to a flow of liquid containing suspended matter, abrasion resistance is of primary importance.

Obviously, the most reliable test is to apply the coating to an area where it will be exposed to actual operating conditions. The abrasion resistance of some types of materials can be compared in the laboratory by using a test instrument such as the Taber Abraser (p. 242).

This instrument uses abrasive wheels which are rotated over a test panel in such a way as to produce a circular as well as a "skidding" motion. A coated specimen is weighed, then inserted in the machine and exposed to a given number of cycles of the rotating abrasive wheels. After a predetermined number of revolutions, usually 500 or 1,000, the specimen is removed and weighed again. Loss in weight is inversely related to the abrasion resistance.

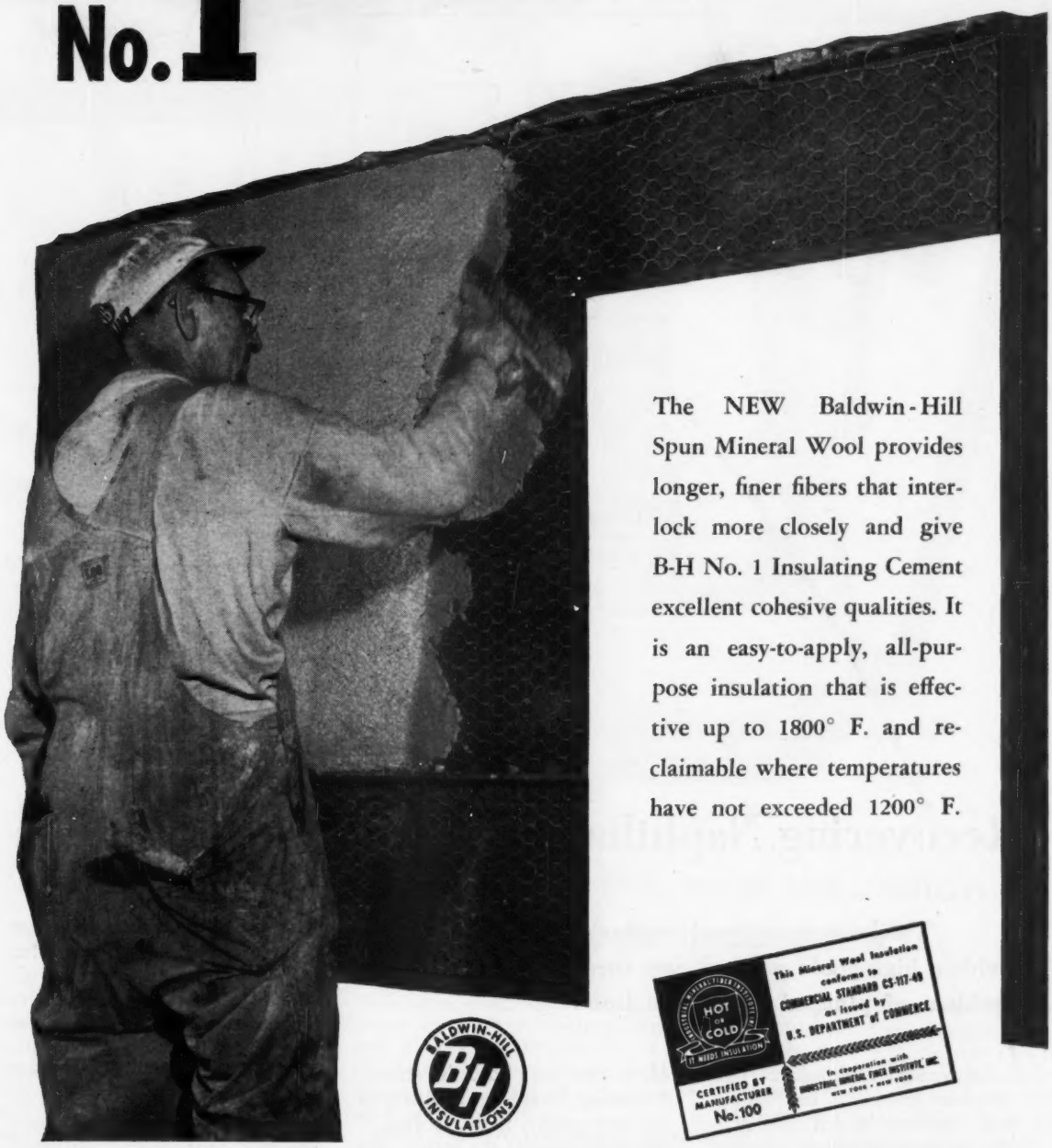
Several different types of abrasive wheels are available, and several different weights can be applied to the abrasive wheels, so that the loss in weight under a number of different conditions can be determined. A standard for an extremely abrasion-resistant coating might be loss in weight of 0.050 grams per thousand cycles, using CS17 wheels with a thousand gram load. A coating which meets this requirement would be expected to give exceptionally long life when exposed to abrasive forces.

All of these tests of a coating's physical properties are relatively simple. They require a minimum of time and technical skill, yet they can help immeasurably toward the weeding out of materials which might fail rapidly in service. Conceivably, the crosshatched panels which reveal the character of a coating's adhesion can save thousands of dollars if such a test should eliminate a large scale application of a poorly adhering material. Likewise, the simple tests for flexibility and abrasion resistance serve as two more challenges to any coating.

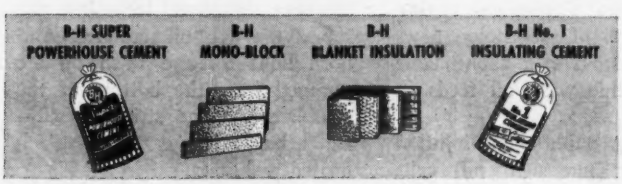
These tests are not intended to serve as a basis for recommendation in every instance. Obviously, many exposures will present specific requirements which must be considered on an individual basis.

Holds together better than ever . . .

BALDWIN-HILL No. 1 INSULATING CEMENT



The NEW Baldwin-Hill Spun Mineral Wool provides longer, finer fibers that interlock more closely and give B-H No. 1 Insulating Cement excellent cohesive qualities. It is an easy-to-apply, all-purpose insulation that is effective up to 1800° F. and reclaimable where temperatures have not exceeded 1200° F.



BALDWIN-HILL COMPANY

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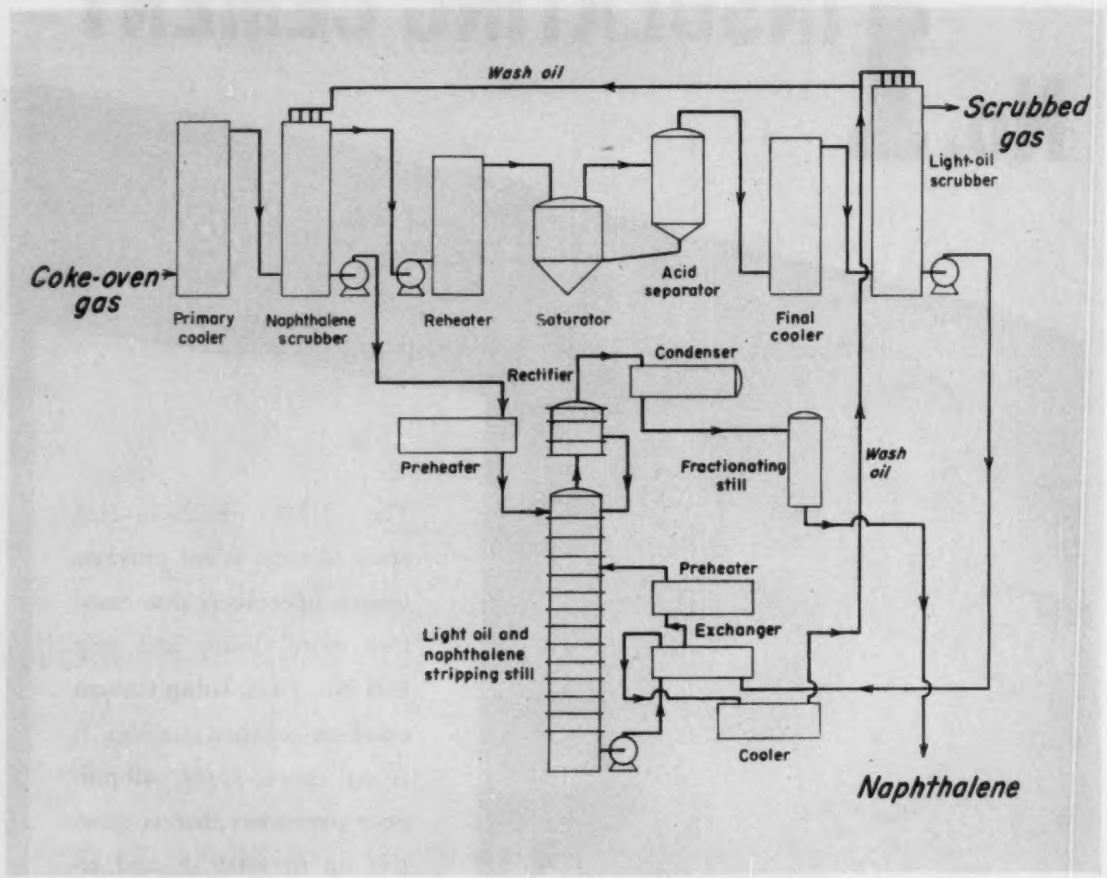


Recovering Naphthalene From Coke-Oven Gas

Unlike conventional methods, this new process yields a high-grade product and successfully tackles the problem of plugged equipment lines.

Recovering naphthalene from coke-oven gas serves a two-fold purpose. Not only does it make available an essential organic chemical, but it avoids stoppages in the gas distribution system which might, as a result of naphthalene crystallization, otherwise occur.

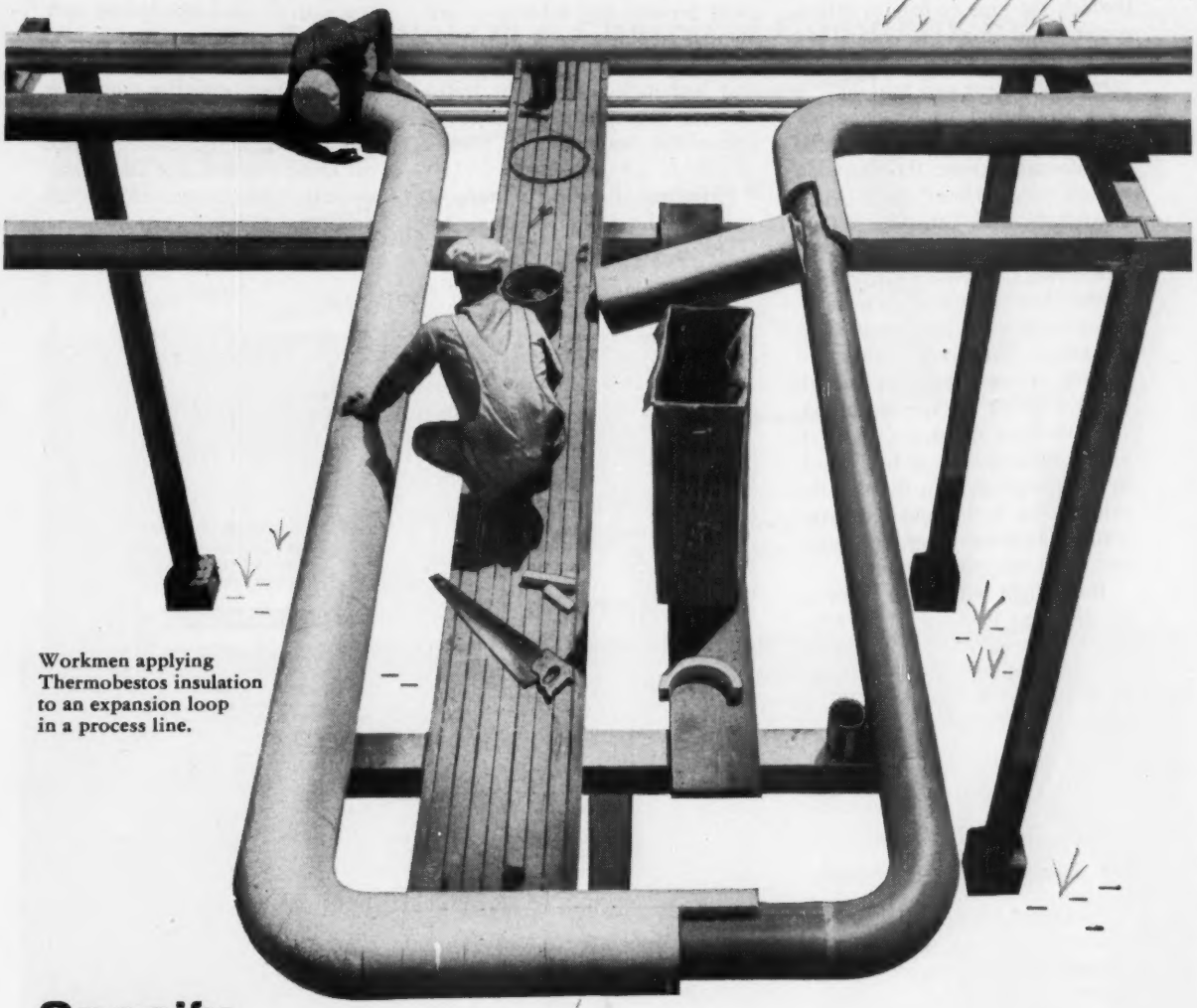
To date, the problem has been how best to effect this separation. With this new improved technique, U. S. Steel may have the answer.

▶ **Cooling, Scrubbing**—First step in the new process is the feeding of coke-oven gas into the bottom of a primary cooler. Cooled gas, exiting from the top of the cooler, flows into the bottom of a naphthalene scrubber while wash oil feeds in at the top.

A wash oil-naphthalene solution (containing some light oil) exits from the scrubber bottom, passes through a steam-heated preheater, thence into the top of a light oil-naphthalene stripping still.

▶ **Scrubbed Gas**—Naphthalene-free gas exiting from the top of the scrubber is given the conventional treatment—i.e., it passes through an exhauster, reheater, saturator, acid separator, final cooler and light-oil scrubber. Wash oil feeds into the top of the light-oil scrubber. And both light oil and wash oil are pumped from the bottom of the scrubber into the stripping still—via a heat exchanger and steam-heated preheater.

When you're fighting the weather as well as heat loss



Workmen applying Thermobestos insulation to an expansion loop in a process line.

Specify

J-M THERMOBESTOS® the heat insulation designed for outdoor process industries

Here's proof that rugged physical strength and high insulating efficiency can be combined in one material. J-M Thermobestos is strong and rigid, yet light enough for easy handling and fast application. It is not damaged by prolonged wetting. Its hard composition resists crushing and will withstand unusual service abuse. The low conductivity compares favorably with other accepted industrial insulations.

This unique combination of properties means excellent temperature control and minimum maintenance cost for oil refineries, chemical processing plants and other plants with outdoor vessels and hot piping.

Made from calcium hydrosilicate, Thermobestos is molded to size for proper fit. Its high strength makes it particularly adaptable for time-saving shop prefabrication of fittings and bends. Furnished in large sections, Thermobestos is easy to apply. It reduces the number of joints. In pipe insulation form, it comes in a complete selection of sizes up to 24″ x 3″ half-sections. Also available in 6″ x 36″ and 12″ x 36″ blocks in a full range of thicknesses. For further information write to Johns-Manville, Box 60, New York 16, N.Y. In Canada, Port Credit, Ontario.

JM PRODUCTS

Johns-Manville *first in* INSULATION

MATERIALS · ENGINEERING · APPLICATION

Wash oil leaving the bottom of the stripping still is pumped through the heat exchanger, into a cooler. And from the cooler, it's recycled to the top of both scrubbers—naphthalene and light-oil.

Light oil and naphthalene are (1) taken overhead from a rectifier mounted above the stripping section, (2) condensed and (3) separated from each other in a fractionating still.

▶**Stripping Still**—The light oil-naphthalene stripper functions as two separate stills, one mounted on the other. The lower section is a light-oil stripper into which enough steam is added to vaporize the oil.

By the time the steam passes up to the wash oil-light oil feed point, light oil passing down through the column has been vaporized. And it therefore flows up—as vapor—into the upper stripping section.

Here, light oil vapors serve as the stripping medium for naphthalene, thus effecting considerable savings in steam.—**U. S. 2,710,663 by Phillip J. Wilson, Jr. to U. S. Steel Corp.**

Synthesis and Extraction Of Aromatic Compounds

Aromatics—their production and extraction—are the subject of two patents recently assigned to Dow Chemical Co.

• U. S. 2,711,420 by John H. Brown, Jr. and George R. Martin, describes an improved method for producing benzene and toluene from synthesis gas.

• U. S. 2,711,433, by Noland Poffenberger, describes a modification of the Udex process for extracting aromatics from non-aromatics with diethylene glycol.

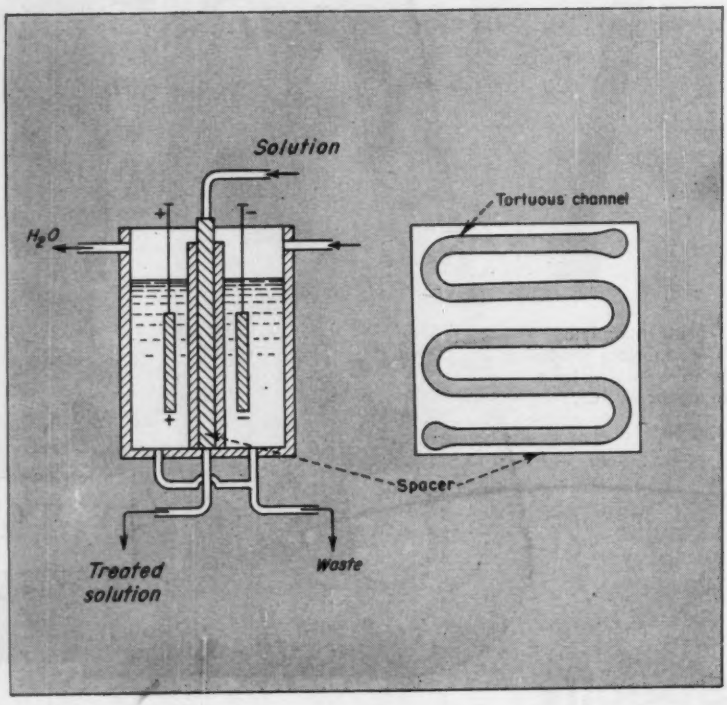
▶**Production**—Instead of fractionating the synthesis reaction product and using only a select fraction as feed to the aromatization reactor, Dow uses the entire reaction product to produce benzene and toluene.

Briefly, the new technique involves (1) using the conventional hydrogenation catalyst to produce aliphatic hydrocarbons and (2) passing the entire reaction product over an aromatization catalyst to yield benzene and toluene in substantial amounts.

The presence of both gaseous and high-molecular weight hydrocarbons surprisingly seems to increase the benzene and toluene yields.

▶**Extraction**—Principal improvement in the Udex process is the removal of low-boiling unsaturates and other non-aromatics by distillation with an azeotrope-former such as acetone.

Acetone forms an azeotrope with the non-aromatics (aliphatics and olefins) but not with benzene. The distillation is therefore carried out using only benzene and lighter aromatic fractions recovered by extraction.



Deionizing Solutions Via Electrolysis

The operating principle of this cell is old, but the cell construction is new.

Based on a simple operational principle, this improved electrolytic cell is designed to deionize solutions.

▶**Ions Migrate**—A d.c. voltage is applied across the cell, causing ions to migrate through selective membranes—anions toward the cathode, cations toward the anode. The result: a solution depleted in ions remains in a central compartment.

▶**Films Minimized**—The improved design (sucessor to a cell described in U. S. 2,708,658) is based on the discovery that the formation of polarized solution films at the inner surfaces of the membranes can be minimized over a wide range

PERFORMANCE AND PRICE...

make Benson Aluminum Drums Ideal for Norda Essential Oil & Chemical Company, Inc.

PROBLEM:

Shipment of aromatic and essential oils for cosmetics and food stuffs by Norda Essential Oil & Chemical Co., New York.
(Galvanized and steel drums cause contamination of oil products. Glass containers too fragile—stainless steel too expensive.)

SOLUTION:

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(Strong, light, corrosion resistant aluminum drums prevent contamination, are highly durable, provide easier handling and storage.)

Light weight of aluminum drums facilitates handling and shipping.

Aluminum drums protect against contamination and shipping damage.

Durable aluminum drums have a long, useful life—despite hard usage.

First cost alone is only the beginning of the savings advantages of Benson Aluminum Drums. Replacements are less frequent—aluminum drums won't rust or shatter. Light weight saves on handling and shipping charges. There are no costs for application of protective coatings . . . no losses through contamination of chemical contents. For further information contact the Reynolds office listed under "Aluminum" in your classified directory or write *Reynolds Metals Company, P.O. Box 1800-CJ, Louisville 1, Ky.*

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REYNOLDS ALUMINUM

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of current densities and concentrations when the solution being treated is forced to follow a narrowly confined, tortuous path as it contacts the membranes.

This leads to a wider range of maximum current and voltage efficiencies without reducing the percentage of demineralization.

The patent describes in detail the operation of single-cell and multiple-cell units.–**U. S. 2,708,658 by Norman W. Rosenberg to Ionics, Inc.**

Pentaerythritol From Formalin and a Nitrile

Here's a new process for making pentaerythritol, an all-important polyhydric alcohol used in the manufacture of alkyd resins and surface-coating formulations.

The technique involves the reaction of formalin with lactonitrile in an NaOH solution. (Conventional preparation: reacting formaldehyde with acetaldehyde in a CaOH solution.)

▶**Typical Example**–In a typical run, formalin (1,830 parts) is alkalized with a 50% NaOH solution (800 parts), then cooled to 15-20 C.

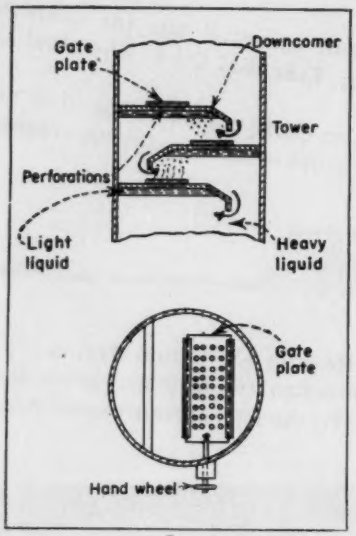
Next, lactonitrile (355 parts) is slowly added to the cooled solution, the reaction temperature being maintained below 30 C. When the reaction is complete, the mixture is gradually heated to 60 C., then neutralized–to a pH of 7.5–with acids.

Evaporation of the neutralized solution produces a supersaturated solution which, on cooling, yields fairly large pentaerythritol crystals. –**U. S. 2,711,431 by Leonard E. Cadwell and Alfred F. Schmutzler.**

Vibration: Key to Smooth Filter Cakes

The filter cake produced on the drum of a rotary suction filter can be smoothed and compacted by vibration. And here's how it's done.

Vibrators are mounted on flexible, rather than rigid supports. In this way, the pressure exerted by the vibrators on the filter cake can be adjusted–depending on the nature of the cake–to level out irregularities on the cake's surface. –**U. S. 2,711,254 by Valere E. F. C. G. Allard.**



New Tower Design Boosts Contacting Efficiency

Highlighting this novel liquid-liquid contacter is a dispersion area subject to control so that a wider range of flow rates may be used without adversely affecting contacting efficiency.

▶**Downcomer**–As shown, the contacter contains perforated trays which occupy only a portion of the tower's cross section. Each tray has a downcomer made up of two sections–one, sloping at an angle of 30 degrees; the other, vertical.

The downcomer terminates above, and is on a line with, the edge of the perforated section of the plate immediately below it so that the heavy liquid phase flows down from plate to plate across each perforated tray while the light phase bubbles up through the perforations.

▶**Gate Plate**–Superimposed on each tray is a gate plate which can be moved back and forth (by a hand wheel) to vary the orifice area. Anti-friction rollers facilitate the plate's sliding.

Each plate is provided with hand-wheel controlled, torque-type, liquid-level indicators so that the tower operator will know the height of denser liquid on each plate.

In addition to the above, the patent describes other modifications in tower design–all aimed at improving contacting efficiency.–**U. S. 2,710,890 by Walter H. Rupp, Clinton H. Holder and Robert B. Long to Esso Research and Engineering Co.**

Anhydrous Hydrazine In Liquid Ammonia

Add this new process to the growing list of ways to produce anhydrous hydrazine.

Basically, the new technique consists of passing anhydrous gaseous chlorine into a large excess of anhydrous ammonia gas to form anhydrous chloramine.

Unreacted anhydrous ammonia is condensed to a liquid. And chloramine is contacted with a large excess of liquid ammonia to form a solution of anhydrous hydrazine in liquid ammonia.–**U. S. 2,710,248 by Harry H. Sisler and Robert Mattair to Ohio State University Research Foundation.**

Boosting Yield of Photochemical Reaction

Interested in photochemical reactions? Then you'll want to take a look at this new process.

It deals with the absorption of sulfur dioxide and chlorine in a hydrocarbon feed going into a photochemical sulfo-chlorinating reaction.

The process is especially geared to recovery of unconsumed SO_2 and Cl_2 by absorption in the hydrocarbon feed.–**U. S. 2,709,155 by Harry E. Cier to Esso Research and Engineering Co.**

This department is designed to keep you abreast of the latest developments in chemical equipment and processes. Any patents may be ordered from the Commissioner of Patents, Washington 25, D. C. at 25 cents each.

A pencil pokes through this corroded metal! Why chance trouble like this? Cathodic Protection and Anaconda Type CP Cable effectively check corrosion of buried metals.

CHECK CORROSION by cathodic protection with Anaconda Type CP Cable

Corrosion of buried metals costs industry over a *billion dollars a year!*

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Would you like more information on how Cathodic Protection checks corrosion?...and detailed information on Anaconda Type CP Cable? Ask the Man from Anaconda – or send for bulletin DM 5450, "Anaconda Cathodic Protection Cable." Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

5534B

* Reg. U. S. Pat. Off.

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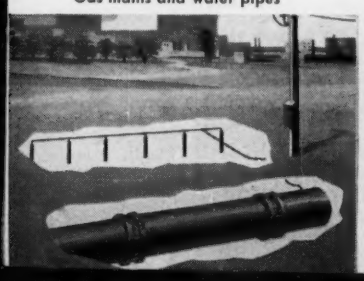
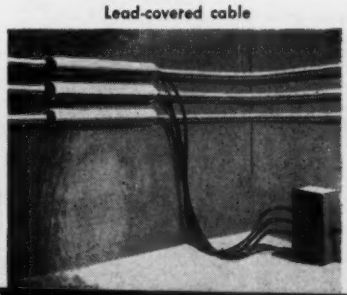
Gas mains and water pipes

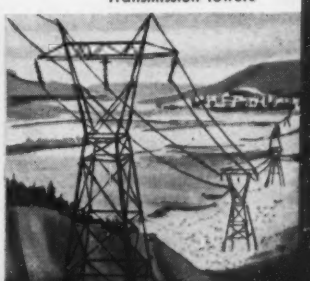


Lead-covered cable



Underground storage tanks

Transmission towers



Your Checklist of New Equipment Patents

Operation . . .	About . . .	Inventor or Assignee . . .	Patent No.
Crushing and grinding	Centrifugal grinding mills	Alpine Aktiengesellschaft	2,712,416
Distillation	Device for controlling pressure in a column having total vapor condensation	Universal Oil Products Co	2,711,992
	Spinning-band fractionator	E. I. du Pont de Nemours & Co	2,712,520
Filtration	Filter bottoms	Pintsch Bamag A.G	2,710,692
	Continuous filter-drum construction	Texas Co	2,710,693
	Vacuum filter	Societe Mines et Industries	2,711,251
	Rotary filter with pulsating blowback	Frank W. Young	2,712,387
Fluid and particle flow	Lift for elevating granular solids	Houdry Process Corp	2,711,350
	Treating subdivided solids	Esso Research & Engineering Co	2,711,387
	Gas-solids contacter	Food Machinery & Chemical Corp	2,712,361
	Conveying granular solids	John Happel	2,712,476
Gas absorption	Grid-tray contact column	Shell Development Co	2,711,308
Heat transfer	Fluid heating furnace	Chemical Construction Co	2,712,303
Instrumentation and control	Electromagnetic pressure gage	U. S. Atomic Energy Comm	2,710,538
Liquid-liquid separation	Liquids separation via thermal diffusion	Standard Oil Co. (Ohio)	2,712,386
Screening	Rotary trommel with internal grizzly	Thomas R. Clark	2,711,250
Solid-gas separation	High-tension electrode for electrical precipitator	Western Precipitation Corp	2,711,224
	Electrified centrifugal gas cleaner	Research Corp	2,711,226
	Combination scraper-rapper for electrostatic precipitator	APRA Precipitator Corp	2,712,362
Solid-liquid separation	Centrifuge	Elmer Denman	2,710,718
	Centrifuge for separating sludge from liquids	Aktiebolag Separator	2,711,854
Solid-solid separation	Sink-float apparatus	Pickands Mather & Co	2,710,691
	Drum magnet separator	A.G. fur Unternehmungen der Eisen- und Stahlindustrie	2,711,249
	Flotation machine	Bolidens Gruvaktiebolag	2,711,823

. . . And New Process Patents

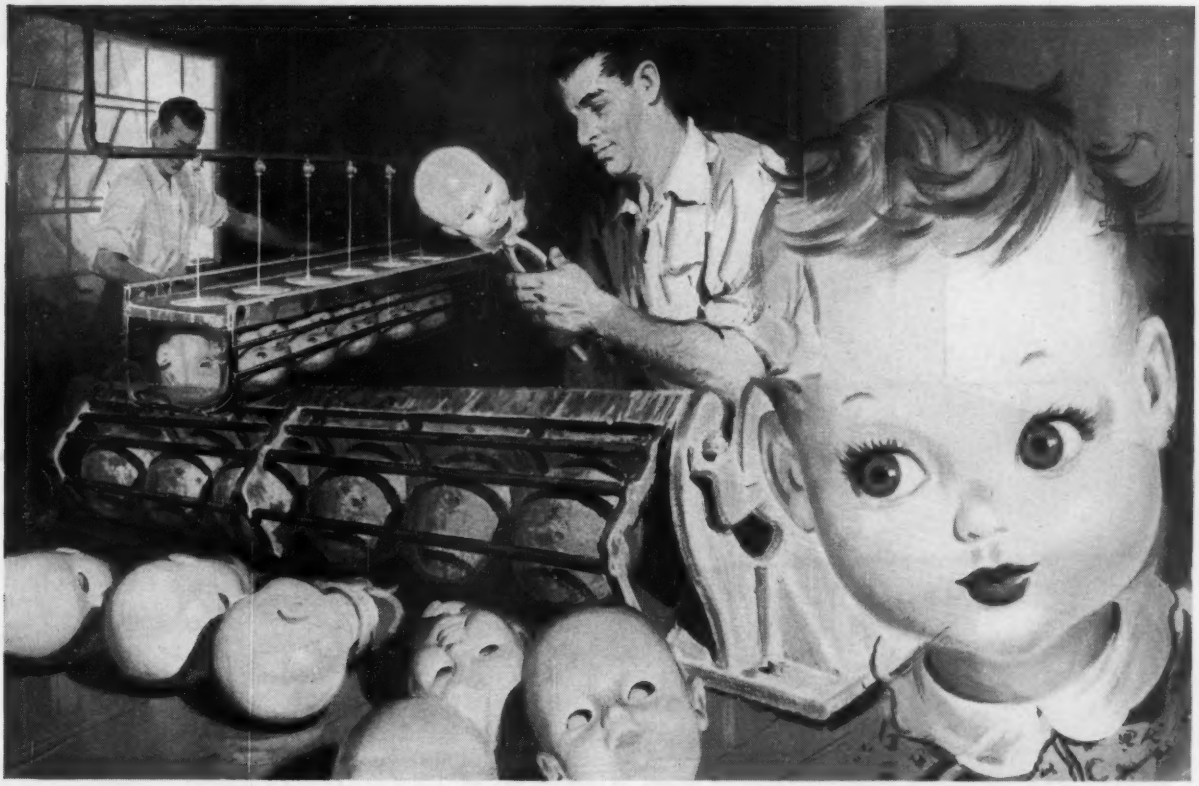
Product . . .	Process . .	Inventor or Assignee . .	Patent No.
Essential oils	Production of terpeneless essential oils	Sec. of Agriculture	2,712,008
Fats and oils	Dehydrating castor oil	Imperial Chemical Industries Ltd	2,711,416
	Hydrocarbon-drying oil production	Esso Research & Engineering Co	2,712,562
Fuels	Fuel gas manufacture	Surface Combustion Corp	2,711,419
Gases	Air separation	Air Products Inc	2,711,085
Hydrocarbons	Vertical shale retorting with intermediate oil recovery	California Research Corp	2,710,828
	Catalytic reforming heat recovery and product separation	Fluor Corp., Ltd	2,711,385
	Gas lift operation in moving bed conversion of hydrocarbons	Houdry Process Corp	2,711,386
Inorganic chemicals	Preparation of pure potassium nitrate	Brevetti Di Procedimenti Chimici S.r.l.	2,710,789
	Sodium from sodium ferrite	E. I. du Pont de Nemours & Co	2,710,798
	Purifying titanium tetrachloride	National Lead Co	2,712,523
Metals and ores	Dewatering aqueous lead sludges	E. I. du Pont de Nemours & Co	2,711,686
	Separation of nickel from a mixture containing soluble cpds. of nickel and cobalt	Chemical Construction Corp	2,711,958
Organic chemicals	Preparing nitro aliphatic cpds	General Tire & Rubber Co	2,710,830
	Succinaldehyde manufacture	E. I. du Pont de Nemours & Co	2,710,883
	Acetylation of thiophene cpds	Dow Chemical Co	2,711,414
	Amides preparation	Esso Research & Engineering Co	2,711,415
	Recovering organic acids from fermentation wastes by iron salt precipitation	Sec. of Agriculture	2,711,425
	Control of temperature in olefin carbonylation	Imperial Chemical Industries Ltd	2,711,429
	Oximes production	Badische Anilin- & Soda-Fabrik A.G	2,712,032
	Alkylating aromatic hydrocarbons	Sun Oil Co	2,712,033
	Ammonium cyanate from urea	American Cyanamid Co	2,712,491
	Ammonium cyanate preparation	American Cyanamid Co	2,712,492
	Separation of vitamin A palmitate	Merck & Co., Inc	2,712,515
	Soybean protein manufacture	Buckeye Cotton Oil Co	2,712,539–40
	Preparation of toluic acids	Richfield Oil Corp	2,712,549–51
	Alkynols from solvated acetylene via ethynylation	General Aniline & Film Corp	2,712,560
Pigments	Stabilization of zinc sulfide white pigment	Monsanto Chemical Co	2,711,968
Resins	Stabilized chlorine-containing vinyl resins	Ferro Corp	2,711,401
	Production of methylol acetone resin precondensate and impregnation of fabrics	Calico Printers' Assn. Ltd	2,711,971
	Synthetic resins from hydrocarbon pyrolysis products	Pan American Refining Corp	2,712,538
Rubber	Preparation of silicone rubber with preaged carbon black	General Electric Co	2,711,399
	Preparation of mixtures of rubbery butadiene-styrene copolymer with resinous polymer of vinyl or vinylidene chloride	B. F. Goodrich Co	2,711,400
	Treating sheet sponge rubber	U. S. Rubber Co	2,711,969
	Impregnating sponge rubber from frothed rubber latex	U. S. Rubber Co	2,711,977
	Bonding polyethylene to butyl rubber	U. S. Rubber Co	2,711,985
	Bonding rubber to chloro-sulfonated polymers	E. I. du Pont de Nemours & Co	2,711,986
Synthesis gas and products	Separation of oxygenated cpds. from aqueous solutions	Stanolind Oil & Gas Co	2,710,829
Synthetic fibers	Viscose spinning process	Celanese Corp. of America	2,711,559
	Spinning swollen polyvinyl chloride	Societe Rhodiaceta	2,712,490

EXON: each resin engineered for a specific problem

EXON 654

specifically for

Plastisols



Waste no more time on grinding — EXON 654 never needs it! Even when simple stirring equipment is used, Firestone's plastisol resin readily disperses in plasticizer.

It's an extremely fine powder with high molecular weight, created to impart excellent heat and light stability, physical toughness and chemical stability to your products.

Slush molders particularly will appreciate the exceptional viscosity, stability and flow properties of pastes formulated from EXON 654. These pastes are unsurpassed for processing ease. They gell quickly. And they always coat the mold smoothly and evenly.

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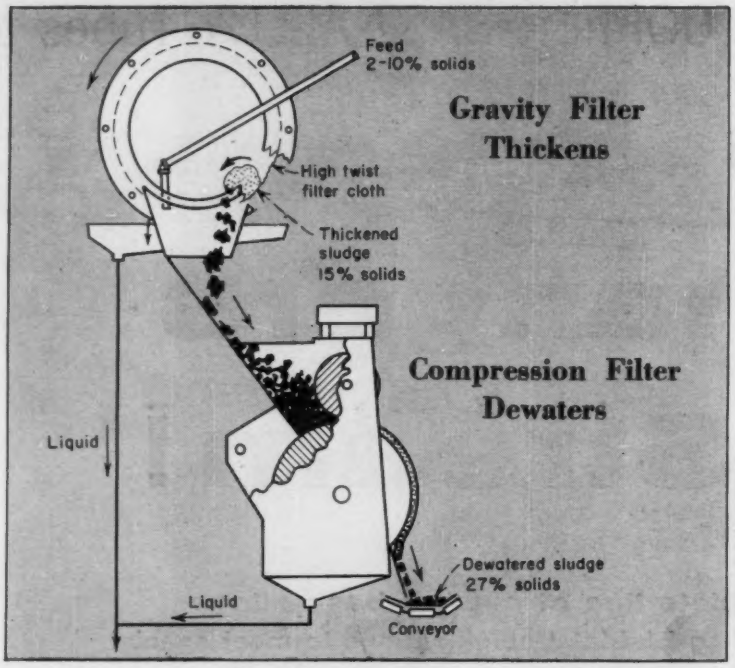

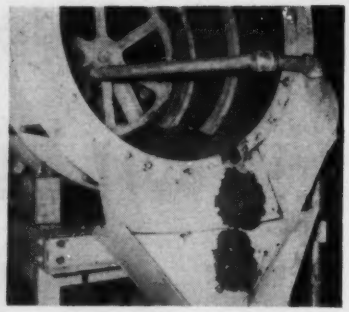

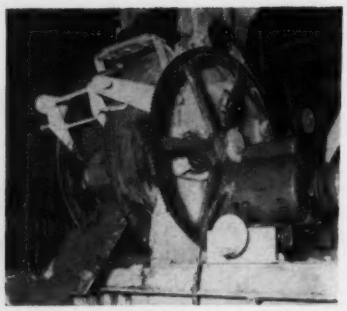

2-Stage Unit Concentrates Raw Sludge

Long-time toughie for dewatering operations, sludge now is concentrated without chemical coagulation. Product is drier, burns without fuel. Cost is low.

A new concept and new equipment are keys to a just-revealed break-through in the field of sludge dewatering. By using two unique stages in series the Edco Sludge Concentrator discharges a 27-32%-solids sludge that can be trucked to disposal point or burned without additional fuel.

Operating continuously, the concentrator uses only one tenth of the power required by vacuum filters handling an equal amount of sludge. Furthermore, chemical flocculation of the feed is not needed. Together, these two factors reduce cost considerably on sludge dewatering operations.

To date, the Edco unit has operated on industrial wastes and products with sludge-like characteristics. Extensive test operations have been carried out with excellent results at the municipal sewage treatment plant, New Brunswick, N. J.

▶**Handle With Care** – Typical waste sludges, even after thickening contain less than 5% by weight suspended solids. And they are solids whose fragility dictates careful handling to achieve further concentration by a dewatering operation.

Edco has met this problem by acknowledging the difficult sludge characteristics. Instead of trying to overcome or alter basic sludge traits Edco worked at dewatering the "as-is" sludge and brought forth a new concept for freeing water from solids.

In essence, sludge feed drains under extremely small gravity head on a moving high-twist fabric. Solids thickened in this fashion are squeezed to final dryness on a compression filter.

By draining the sludge on the high-twist filter medium, sufficient water is coaxed out of the slurry to permit final dewatering by mechanical action. And the sludge drains without blinding the cloth or slowing the drainage rate.

▶**Close-Up of Thickener**–Liquid sludge fed to the Roto-Plug thickener enters a rotating cylinder whose wall is a drainage deck covered with high-twist medium. A portion of the liquid in the sludge filters through the medium leaving a deposit of partially dewatered solids.

As the cylinder rotates, the deposit rolls towards the lowest point

for Flooded Suction or Suction Lift

It's PACKINGLESS

It's SELF PRIMING

It's CENTRIFUGAL

It's LABOUR

The new Type CG LaBour is an improved model, operating under positive or negative suction lift conditions as required. It has no packing or close fitting parts in contact with the liquid. The open end of the dynamic seal need not be exposed to atmosphere, so escape of volatile or toxic gases may be prevented. The seal can be flushed during normal operation if desired.

Send for your copy of Bulletin G-1, which gives complete details.

ORIGINAL MANUFACTURERS OF THE SELF-PRIMING CENTRIFUGAL PUMP

LABOUR

THE LABOUR COMPANY, INC. ★ Elkhart, Indiana, U.S.A.

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in the cylinder. There, it soon forms into a cylindrical rolling mass.

Two things happen at the point of rolling. The cylindrical mass rolls over material depositing on the medium and expels liquid. At the same time the partially dewatered solids are picked off the medium by the rolling mass.

When the mass reaches a maximum diameter it distends axially. One end of the cylindrical structure supporting the filter medium has a flange that continuously cuts pieces away from the mass of sludge as it pushes out over the flange.

▶ **Final Squeeze**—Separated pieces fall onto the compression filter, a rotating drainage drum with a compression roller. Under compression on the free-draining surface of the drum the solids reach final dewatered state. Then, on the downward turn of the drum they fall away as a continuous sheet onto a conveyor.

▶ **Operating Data** — The Sludge Concentrator, consisting of Roto-Plug thickener and compression filter, will handle feed as low as 2% solids. Thickened material usually leaves the Roto-plug unit at about 15% solids. Final dewatering on the compression filter brings it to 27% solids. Where needed, unit can be modified to give up to 32% solids in the dewatered cake.

Sludge Concentrators are built in a range of sizes starting at 1 ton dry weight capacity per 24 hr. Total power requirement is only ¼ hp. per ton of dry weight solids per 24 hr.

An 8-ton unit occupying a space 10 x 10 x 10 ft. will handle as much tonnage as a 6-ft. dia. by 8-ft. face vacuum filter.—**Equipment Development Co., Inc., 363 Bloomfield Ave., Montclair, N. J.** 260A

Equipment Cost Indexes

Industry	March 1955	June 1955
Avg. of all	186.2	188.1
Process Industries		
Cement mfg.	178.4	180.2
Chemical	187.1	189.0
Clay products	173.2	175.0
Glass mfg.	176.8	178.6
Paint mfg.	180.1	181.9
Paper mfg.	180.4	182.2
Petroleum ind.	183.7	185.6
Rubber ind.	186.1	188.0
Process ind. avg.	184.2	186.1
Related Industries		
Elec. power equip.	188.9	190.8
Mining, milling	188.0	189.9
Refrigerating	206.8	208.7
Steam power	176.3	178.1

Compiled quarterly by Marshall and Stevens, Inc. of Ill., Chicago, for 47 different industries. See *Chem. Eng.*, Nov. 1947, pp. 124-6 for method of obtaining index numbers; March 1955, pp. 178-9 for annual averages since 1913.

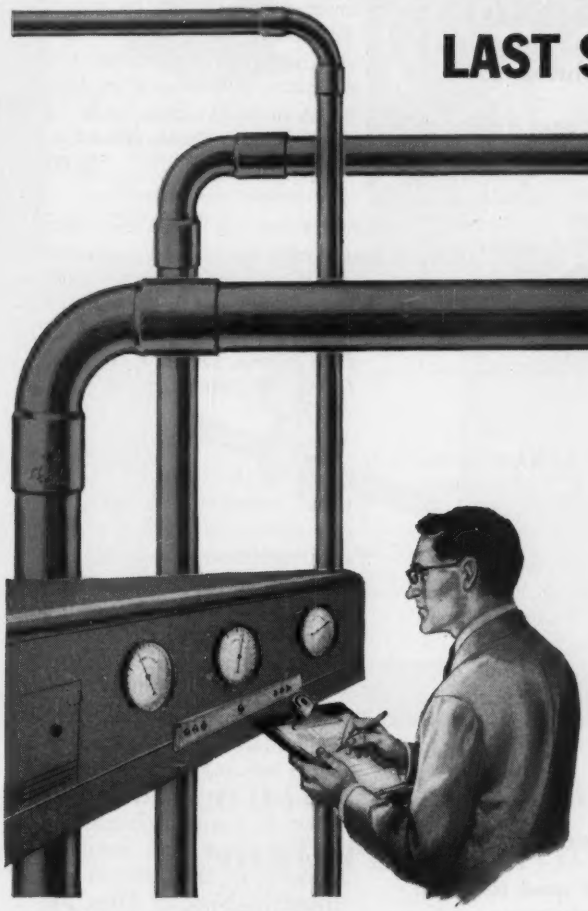
WHY REPLACE...

REPLACE...

REPLACE...

when process lines of CHASE® COPPER TUBE

LAST SO MUCH LONGER!



Nothing mysterious about *why* process lines of Chase copper tube give such extraordinary service. It's just that they're naturally corrosion resistant...can't rust!

What's more, the careful manufacturing process at Chase mills puts a mirror-like finish on the inside surfaces. Clogging deposits can't get a foothold—so Chase copper tube stays free-flowing far longer than rustable process lines.

Such smooth interiors keep fluid friction down to a minimum, too! Pumps do their job with less effort and strain. Even the heaviest industrial fluids move more easily!

Get all the facts on longer-lasting Chase copper tube for process lines. Contact your Chase wholesaler or the Chase warehouse nearest you—today!

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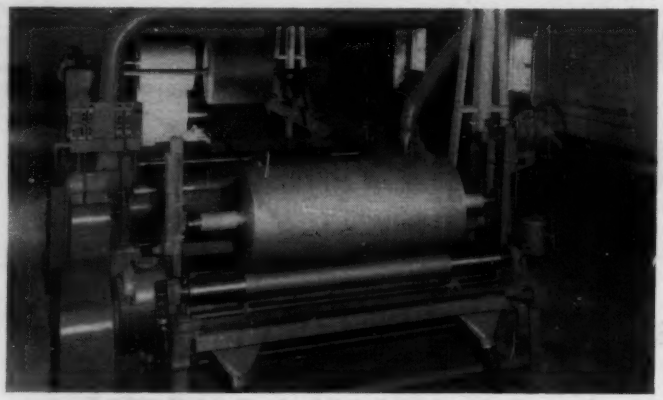
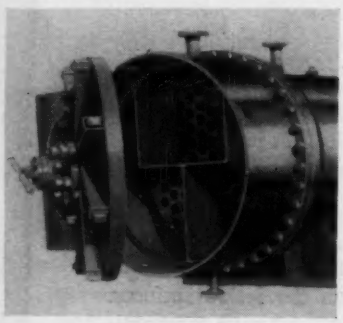


Paper Webs Joined Without Increasing Thickness

Look carefully and you'll see that the two narrow rolls at the far end of the Webwelder machine have been joined to make one roll on the rewind stand at the near end. And it's a roll without the trace of a bulge in the middle where the webs join. Unwinding at speeds of 500 ft. per min. or more the edges to be joined are beveled by rotary grinders. Glue is applied to only one of the surfaces. Then they are joined and pressed together by compression rollls before the web is rewound. Machine will boost mill output by salvaging narrow side rolls.—Dorr-Oliver, Inc., Barry Place, Stamford, Conn. 264A



Quick-Opening Door

Cuts cost of heat exchanger maintenance.

Time to open heat exchangers, autoclaves and the like is reduced considerably by a new self-seating, quick-opening door. It is particularly suited for use on heat exchangers that carry fouling liquids necessitating frequent entry for cleaning and inspection.

Only five seconds are needed to open the Lever-Lock door which is locked and unlocked by bars. These are inserted into and withdrawn from fittings in the vessel by a hand-operated lever. A mechanical safety lock prevents the door from being opened while the vessel is under pressure.

Lever-Lock doors are designed and fabricated to meet all code requirements. They can withstand temperatures from −70 to 400 F and pressures ranging from full vacuum to 300 psi.—**The Patterson-Kelley Co., Inc., East Stroudsburg, Pa. 264B**

Gyratory Screen

Has variable speed to permit optimum performance.

A new gyratory screen built with variable speed drive is said to give throughputs much higher than conventional constant-speed machines.

Design of the machine is based on development work that indicated each material had a critical screening speed. If the frequency of screen gyration is held within the critical range, throughput will be increased several fold. Particularly high throughputs are obtained at higher speeds in the range of 2,500 to 3,000 cycles per min.

Speed can be varied from 1,200 to 3,600 cycles per min. by means of a torque converter. Units are available for either dry or wet screening.—**J. M. Lehmann Co., Inc., 550 New York Ave., Lyndhurst, N. J. 264C**

New design and prices up to 55% lower are announced for porous Teflon and Kel-F in-line filters. One square foot of filter area contained in volume 2 in. high by 3½ in. O.D. Sizes up to 10 sq. ft.—**Porous Plastic Filter Co., Glen Cove, N. Y. 264D**

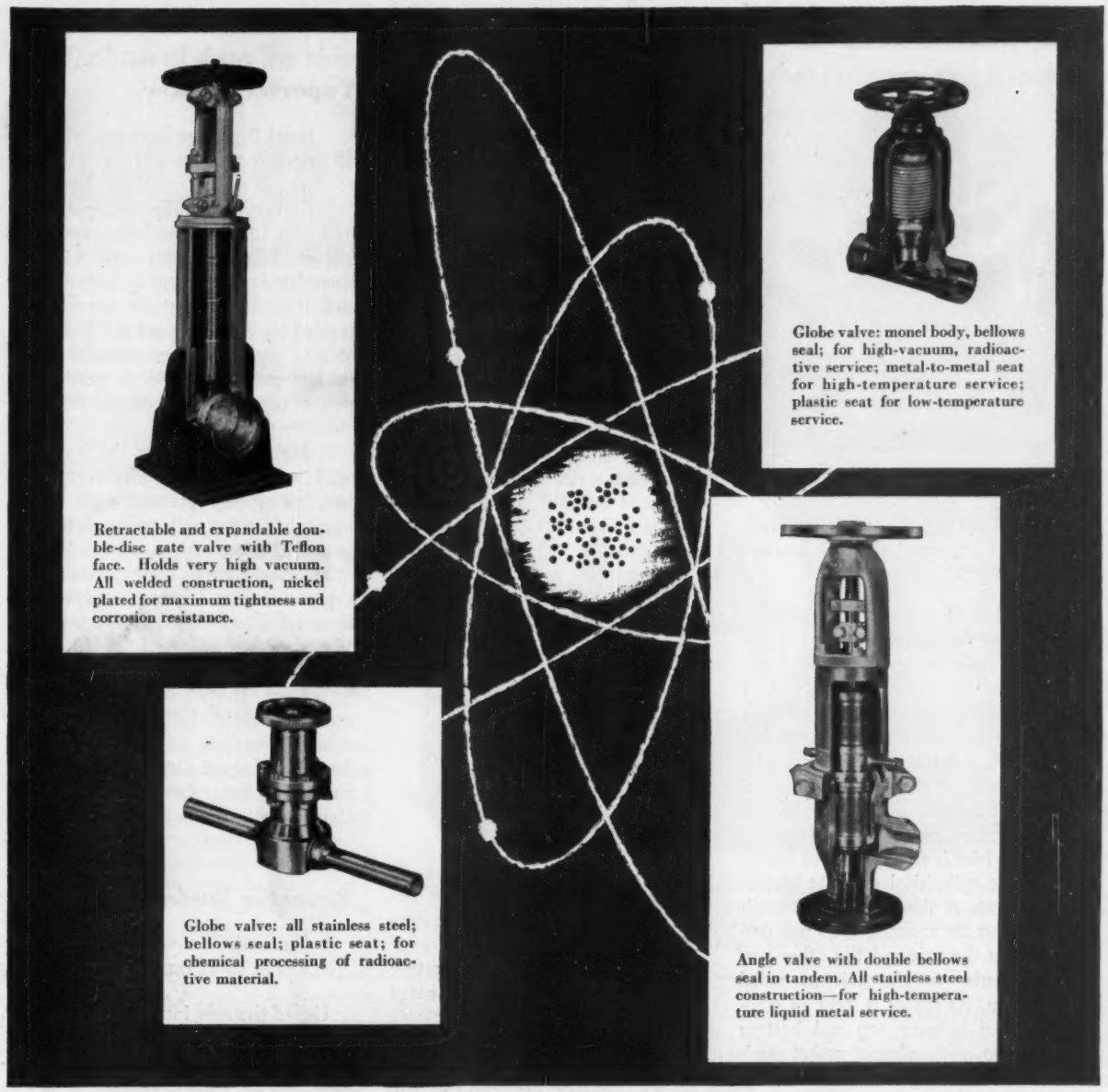
Agitator line newly available offers packaged units that are shipped complete, ready to run. Both turbine and paddle type impellers are included.—**Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia 34, Pa. 264E**

Crusher for the chemical and fertilizer industries reduces moist, granulated and pelletized solids with minimum production of fines and oversize. Internals can be cleaned easily and quickly.—**Pennsylvania Crusher Div., West Chester, Pa. 264F**

Treated cotton filter cloth offers many advantages found in synthetics but costs little more than untreated cotton cloth. Resistant to many chemicals, mildew, shrinkage and wrinkling. Available in the standard constructions.—**National Filter Media Corp., 1717 Dixwell Ave., New Haven 14, Conn. 264G**

For More Information . . .

about any item in this department, circle its code number on the Reader Service Postcard inside the back cover.



Retractable and expandable double-disc gate valve with Teflon face. Holds very high vacuum. All welded construction, nickel plated for maximum tightness and corrosion resistance.

Globe valve: monel body, bellows seal; for high-vacuum, radioactive service; metal-to-metal seat for high-temperature service; plastic seat for low-temperature service.

Globe valve: all stainless steel; bellows seal; plastic seat; for chemical processing of radioactive material.

Angle valve with double bellows seal in tandem. All stainless steel construction—for high-temperature liquid metal service.

Control the flow of radioactive materials with Crane valves

Since the beginning of the AEC program, Crane, with gratifying results, has pitted its knowledge, resources and skill against problems in flow control that never before challenged man's ingenuity.

As a result of its experience, Crane now is producing valves that are used safely in the production of atomic material, and the use of it to produce power.

The four valves shown here are typical of valves now in active atomic energy service. They are, more than likely, prototypes of Crane valves you will need when *you* are ready to apply atomic energy to the production of power, or other processes involving radioactive material. Crane Co., General Offices: Chicago 5, Ill. Branches and Wholesalers Serving All Industrial Areas.

See these valves! Crane Exhibit—Booth 128 Atomic Exposition, Cleveland—Dec. 12-16

CRANE CO.

VALVES • FITTINGS • PIPING
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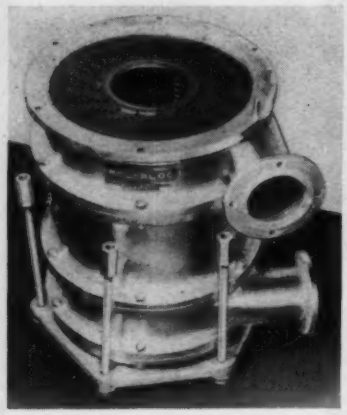
CRANE'S FIRST CENTURY...1855-1955



Heat Exchanger

Constructed of graphite exhibits improved thermal conductivity.

Improved thermal conductivity featured by the new Polybloc corrosion-resistant graphite heat exchanger stems from orientation of the graphite crystals combined with highly turbulent flow. Formation of film and scale is minimized by the turbulent flow. Proper orientation of the graphite crystals insures maximum conductivity of heat.

Polybloc is an assembly of impermeable cylindrical graphite blocks. Two sets of flow passages through the unit are arranged with one parallel to the axis and the other perpendicular to the axis in radial fashion. Assembly is held in compression between top and bottom headers with elastic gasket seals between the blocks.

High turbulence is created by short flow passages. The axial and radial flow passages are in close proximity without interference by insulated cemented joints. — **The Carbone Corp., Boonton, N. J.** 266A

Packaged Generator

Produces steam through heat from electrical resistance of water.

Based on a unique electrode principle the new Speedylectric steam generator produces steam by the simplest, most economical electrical method. Unit is in demand where high-pressure steam temperature must be controlled precisely; where there is an explosion, fire or fume hazard; or where there is a steam demand in an area located remotely from central boilers.

Three electrodes are suspended within the pressure tank. When electric current is turned on, heat is generated by the resistance of the water to passage of current between the solid metal electrodes. The water itself acts as the resistance element; there are no heating elements to burn out or replace. If the electrodes become exposed above the water level there is no danger of burnout because the circuit is broken so that no current can pass.

Speedylectric generators are made in sizes from 1½ to 60 bhp; 15 to 500 psi.—**Pantex Mfg. Corp., 416 Roosevelt Ave., Pawtucket, R. I.** 266B

Steam Generators

Standardized for minimum initial and operating costs.

Aimed at reducing steam costs for industrial plants the New SC series of standard steam generators assures industrial steam users of minimum initial and operating costs together with the advantage of short delivery schedules.

Units offer a selection of maximum working pressures to 1,500 psi. without superheat and to 1,100 psi. with superheat; saturated steam temperatures to 950 F.

By standardizing, blueprints of the SC generators can be furnished almost immediately. Fabrication, delivery and erection can be done in quick order. At the same time there is sufficient flexibility to satisfy individual preference on type of operation, type and location of heat recovery equipment, type and location of fans and drives, oil and/or gas firing, and handling arrangements.

SC generators are built in nine different sizes with capacities from 50,000 to 150,000 lb. per hr.—**Foster Wheeler Corp., 165 Broadway, New York 6, N. Y.** 266C

Vaporizer-Mixer

For LP gas produces gas with desired Btu. content.

Self-contained, fully automatic, packaged LP gas vaporizers, vaporizer-mixers and mixers now have been developed for use by industry and utilities. No outside power is needed for delivering gas at 1-5 psi. Where higher pressure mixed fuel or low pressure liquid is needed power may be required to drive auxiliary pumps.

Using a venturi mixer the packaged mixers and vaporizer-mixers mix butane and propane with air to produce a gas with any predetermined Btu. content.

Standard and high pressure vaporizer-mixers have capacities from 1,000 to 50,000 cu. ft. per hr. Vaporizer sizes range from 40 to 800 gal. per hr.; mixers from 100 to 50,000 cu. ft. per hr. Vaporizers can be heated by direct firing, steam, electricity or hot water.—**American Liquid Gas Corp., 1109 Santa Fe Ave., Los Angeles 21, Calif.** 266D

Transfer Surface

Has both internal and external fins to boost transfer rate.

Use of the new Inner-Fin surface is said to permit construction of smaller, lighter heat transfer units. Any type of heat exchange, be it air-to-air, liquid-to-air or liquid-to-liquid, is accomplished more efficiently with Inner-Fin heat exchange elements.

Fundamental principle of patented Inner-Fin is the arrangement of longitudinal fins inside a tube in conjunction with outer fins. A smaller inner tube is expanded mechanically to lock the longitudinal Inner-Fins closely to the inner wall of the outside tube and outer wall of the inside tube. If needed, the surface then can be brazed. According to the application the inner tube can be utilized either as a separate circuit or sealed off.—**Bush Mfg. Co., West Hartford, Conn.** 266E

Technical data on the revolutionary new

holo-flite*

(HOLLOW-FLIGHT)

PROCESSOR

—the Continuous-Flow Heat-Exchanger that is setting new standards of *compactness! adaptability! simplicity!*

If you have processing operations where slurries, solids, pulps or pastes must be cooled or cooked, be sure to investigate the many unique advantages of the newly-developed HOLO-FLITE Processor before you install *any* heat-exchange equipment.

Here's the HOLO-FLITE principle...

Two or more screw conveyors rotate slowly in a trough. The blades and shaft of each flight of conveyors are hollow, with provision for circulating the heat-transfer agent through them. The product to be cooled or cooked is moved along the trough, being constantly rotated into, around, over and under the conveyor screws as it moves.

Thus, a continuous thermal transfer takes place between the product and the heat-transfer fluid circulating in the blades. The product is cooled or cooked in *continuous-flow* without the "stop-and-go" losses of batching operations . . . and cooled products can be packaged directly from the HOLO-FLITE discharge—saving space, time and additional handling.

THIS 6-TIER HOLO-FLITE cools 7 tons of cottonseed press cake per hour from 285° to 89°F. *in a total floor space of only 28 sq. ft.* *(Inset)* Enlarged cutaway view of HOLO-FLITE screw showing heat-transfer principle.

Here are typical HOLO-FLITE advantages

The HOLO-FLITE principle is so unique it is setting completely new standards of performance in *many* ways. For example...

*Reg. T.M.

The HOLO-FLITE Saves Space—It requires as little as 1/5th the space of other units of comparable capacity because (1) it has far greater heat-transfer area per cubic foot of space . . . and (2) the flights can be "tiered" as high as desired to give maximum capacity in very small floor areas.

The HOLO-FLITE is Versatile—Processed product can be fluid, pulp or paste—granular, crystalline or powdered solid. Heat-transfer fluid can be refrigerant, cooled or ambient water, steam, oil or any other desired fluid, at any normal temperature range.

The HOLO-FLITE Is Dust-Free—Its gentle action provides large heat-transfer action without dust and with negligible particle abrasion. Simplifies installations, assures higher quality product.

The HOLO-FLITE Is Adaptable—It can easily be designed to handle virtually any capacity by (a) varying the diameter of the screws (7" to 16")... (b) varying the length of the screws (8 ft. to 20 ft.)... (c) varying the number of intermeshing screws per trough (2, 4, or 6) ... and (d) varying the number of tiers stacked on top of one another (1 to 10, or more).

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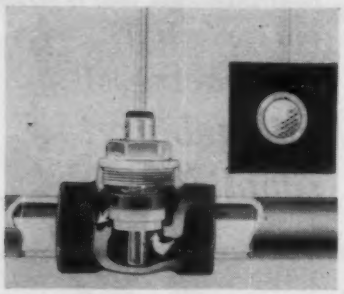
PRECIPITATION CO. OF CANADA, LTD., DOMINION SQ. BLDG., MONTREAL

The HOLO-FLITE is in daily operation on such typical products as sand, cement, cottonseed cake, soybean meal, borax, salt, sugar, baby foods and many other equally-varied products.

What is your problem? *Our engineers will be glad to assist you in making the most of* HOLO-FLITE *advantages. Write wire, or phone the office nearest you!*

Want More Facts? This 8 page booklet describing the HOLO-FLITE in greater detail will gladly be sent on request. No obligation, of course.



Flow Indicator

Monitors liquid flow in pipeline.

Using a standard tee pipe fitting for a body, Model FI-200 flow indicator shows liquid flow or lack of flow through a pipeline. Flow through the unit actuates a switch that can be used to operate a pilot light, horn or other warning signal. With suitable relays it also can operate preventive interlocks.

Instrument is said to be unusually compact and simple, dependable, and easy to install. It is now available for pipe sizes from ¼ to 3 in.—**Gems Co., 64 Welles Dr., Newington, Conn.** 268A

Bin Level Indicator

Takes over jobs diaphragm indicator cannot handle.

Some bins present special problems in measuring level. That's why the new Roto-Bin-Dicator was developed. It can be used under pressure or vacuum; where there are large lumps that tend to bridge over a diaphragm-type indicator; or where materials tend to "rathole" preventing operation of a diaphragm.

Basic element of the Roto-Bin-Dicator is a slowly rotating paddle, mounted on flexible shaft. The paddle projects into the bin and is driven by a small motor mounted externally.

As material rises in the bin it reaches the point where it covers the paddle, stopping rotation. Torque exerted by the motor actuates a Microswitch that controls signals or motors of conveyors or feeders in the housing. When material drops below the paddle, rotation resumes and the Microswitch returns to normal position.—**The Bin-Dicator Co., 13946-39 Kercheval Ave., Detroit 15, Mich.** 268B

Calibrator

For strain gages up to 200,000 lb.

A new primary calibrator for strain gages, load cells, etc., is claimed highly accurate up to 200,000 lb.

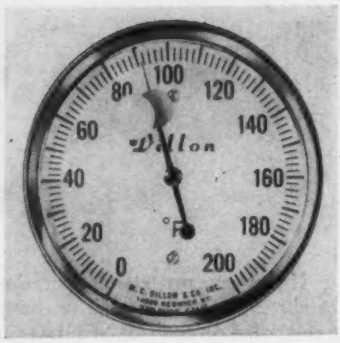
Calibrator consists of a thrust load generator and a pressure balance connected by means of high-pressure tubing. It is virtually frictionless, simple in principle and construction, and widely adaptable to various applications. Device is completely self-contained, has no packing, is self-lubricated. —**American Instrument Co., Inc., Silver Springs, Md.** 268C

Data Processing Center

Tackles any problem on a fee basis.

When told of the exploits of some of the latest high-speed digital computers and data processing equipment you may have passed them off as gross exaggerations. Now you have the opportunity to check out some of the claims and at the same time gain insight into how they can help you.

During July, IBM opened a new electronic data processing center in New York that contains an integrated team of so-called "giant brains." The versatile combination of machines makes available to companies, on an hourly charge basis, the latest tools for scientific management. They are expected to be used both by companies which do not need full time data processing facilities of such capacity and speed and to companies whose own facilities may be overloaded.—**International Business Machines Corp., 590 Madison Ave., New York 22, N. Y.** 268D



Signal Thermometer

Flashes variation from standard temperature.

For thermometer locations where actual temperature is hard to read the new Signal Eye thermometer tells the operator of a variation at a glance.

The pointer of the bimetallic thermometer carries a bright red disk. An opaque disk of the same diameter is attached to the dial glass to coincide exactly with the position of the red disk.

Slightest temperature variation causes the pointer to fluctuate above or below the opaque circle thus revealing the red signal to the operator. Should the standard operating temperature be changed the opaque disk can be relocated to give warning in the new range.—**W. C. Dillon & Co., P. O. Box 3008, Van Nuys, Calif.** 268E

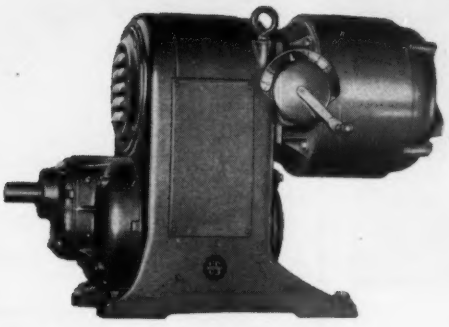
Heat Indicator

Thermocouple thermometer.

To make possible quick visual checking of critical temperature points a new Check Well combines a sensitive thermocouple with a dial type thermometer. Unusually high rate of response is due to the small ⅛-in. O.D. thermocouple protection tube with subsequent low mass, low thermal inertia and to light-gage thermocouple element with hot junction bottomed in tube. Sealing method and protection from oxidation and corrosion permits element to be removed with minimum time loss.

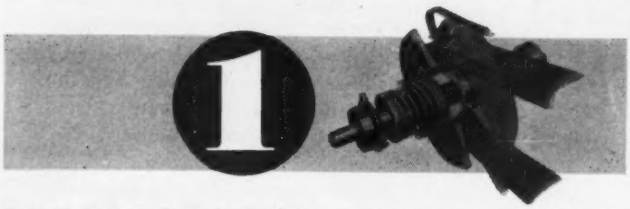
Teflon is the standard sealant. Both protection tubes are made of

3 GREAT FEATURES
Unique with
U. S. VARIDRIVES



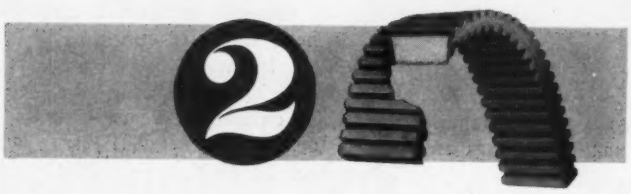
...for dependable, long-life, Variable Speed

With a U. S. Varidrive motor you can get instantly all the speeds needed for every operating condition. You can have infinite speeds at your instant command without resorting to cumbersome speed-changing contraptions and costly external equipment. The Varidrive combines all equipment in one compact "package," occupying little more space than an ordinary motor, for convenient installation.



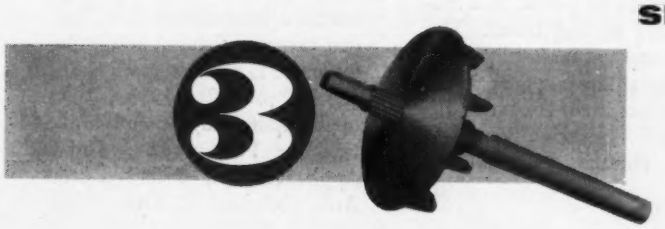
AUTOTAUT TENSION CONTROL

Autotaut automatically compensates for wear, stretch and changes in length of the belt drive due to temperature and, therefore, does not require manual adjustment. It establishes the exact tension by employing the positive movement afforded by a live, resilient spring which has been accurately calibrated at the factory.



DOUBLE-RIBBED BELT

By application of the double-ribbed design, smaller diameters and greater speeds can be combined. The result is maximum motor compactness. This type belt provides double corrugation, reduces internal friction and permits greatest flexibility. The Varibelt has highest resistance to heat, oil and grease, and is protected from drippings by complete enclosure.



SLIDING SPLINE

Instead of relying upon a common key to connect the shaft and sliding Varidisc, the U. S. Varidrive gears parts together with an involute spline. Load is equally among 16 integral teeth cut in the shaft. Both motor and driven shafts in the Varidrive are splined. Integral teeth provide maximum strength with minimum diameter, and reduce wear and vibration.

U.S. MOTORS

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CE-11

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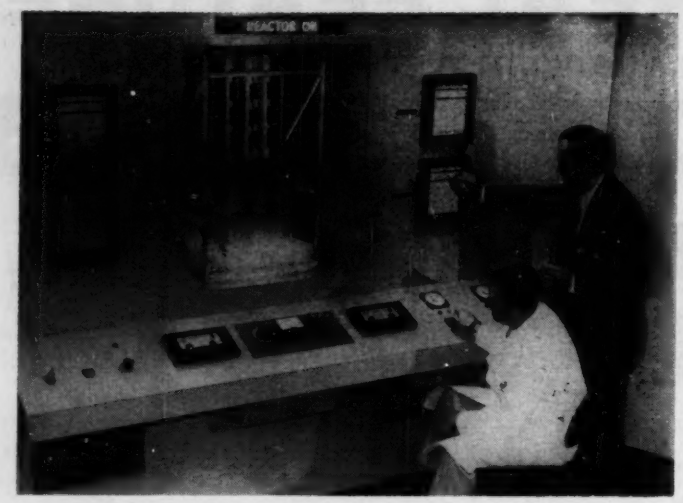
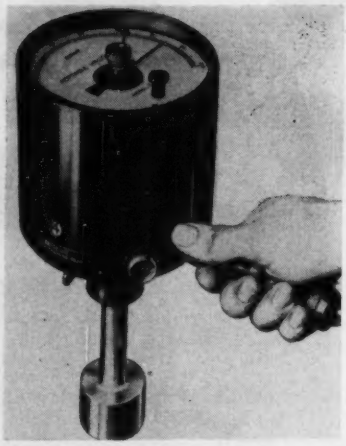


Reactor Simulator for Nuclear Fledglings

By watching the model reactor operate as he manipulates the controls this trainee is learning how to start up, maintain, increase and stop an atomic chain reaction. Even the telltale ghostly blue glow of the Cerenkov effect is simulated in this model of a swimming pool type. As complex kinetic equations are demonstrated, the trainee can see graphically the delayed neutron effects "on the way down" and the integrated effects "on the way up." Although the reactor is only a scale model the control panel is full size and completely equipped.–Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia 44, Pa. 270A



Viscometers

Two types; one fixed, the other portable.

Two new viscometers have just been introduced to the American market. The first, a cone and plate instrument, measures flow properties of simple or complex fluids simply and rapidly. Less than 0.5 ml. of sample is needed, and the thin film permits reaching a stable temperature almost instantaneously for rapid determinations.

The portable instrument uses the coaxial cylinder principle. Outer cylinder rotates and the viscous drag on the inner cylinder is opposed by a calibrated spring and measured. Instrument is protected against shocks and is easily taken apart for cleaning.–**Ferranti Electric, Inc., 30 Rockefeller Plaza, New York 20, N. Y. 270C**

Type 304 stainless steel. The process connection and packing glands are machined from Type 303 stainless steel bar stock.–**Conax Corp., 7811 Sheridan Dr., Buffalo 21, N. Y. 268F**

Digital Totalizer

Converts analog readings of dial scale to totalize batch weights.

A recently announced totalizer converts weight readings of a dial scale to digital equivalents. It is especially suited for controlling the receiving, shipping and processing of material through an automatic hopper scale that is connected to a dial scale.

Used with any industrial scale the new totalizer can be controlled remotely. It gives a continuous running total weight of batches discharged by the hopper scale regardless of how many weighings are made.

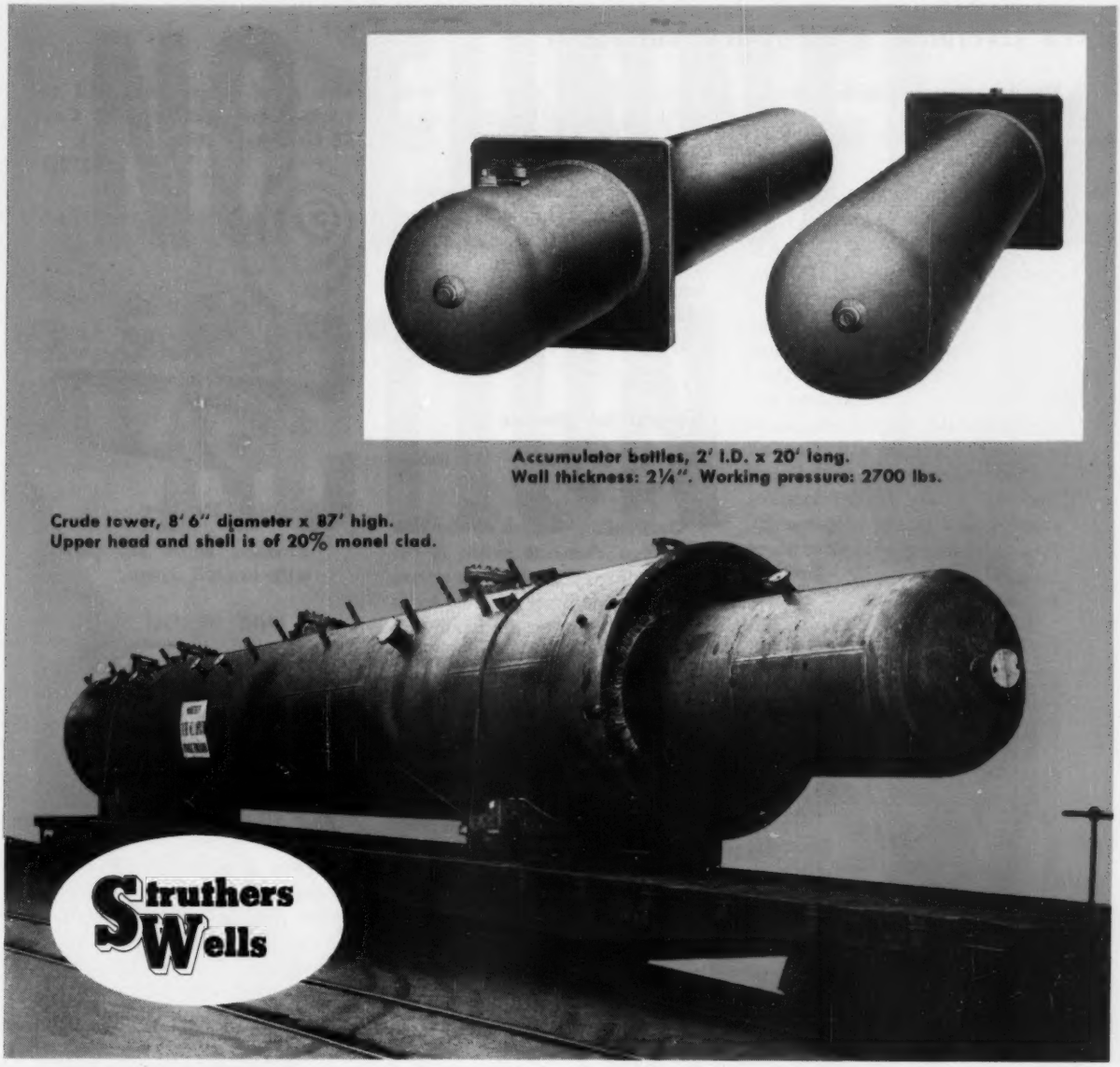
In a typical batching operation where several materials are mixed totalizers would be placed on a centrally located control board. The various amounts of material present in the mixer at any one time would be read immediately from the different totalizers.–**Richardson Scale Co., Van Houten Ave., Clifton, N. J. 270B**

Pressure snubber that protects sensitive instruments from sudden pressure changes now is being made in stainless steel. Rated at 5,000 psi., offers 13 gradations of damping adjustment.–**Tube & Hose Fittings Div., Parker Appliance Co., 17325 Euclid Ave., Cleveland 12, Ohio 270D**

Pulp density scale permits direct reading of sample weight; specific gravity of liquid, dry solids and pulp; and percent solids of a pulp of a given specific gravity. –**The Mine and Smelter Supply Co., 1431 17th St., Denver, Colo. 270E**

For More Information . . .

about any item in this department, circle its code number on the Reader Service Postcard inside the back cover.


Accumulator bottles, 2' I.D. x 20' long.
Wall thickness: 2¼". Working pressure: 2700 lbs.
Crude tower, 8' 6" diameter x 87' high.
Upper head and shell is of 20% monel clad.
Struthers Wells

DEPENDABLE PROCESSING PERFORMANCE IS ASSURED

...when Equipment is Designed and Fabricated by Struthers Wells

Process equipment such as that illustrated above constantly rolls out of our modern, efficient plants—to meet the exacting specifications and delivery requirements of valued customers in the chemical and petroleum processing industries. Intensive experience in the design and fabrication of standard or specialized processing equipment—regardless of size, specifications or codes—has built an enviable reputation for us in the construction of highest quality products that provide service of utmost satisfaction. Yes . . . in choosing Struthers Wells as your process equipment fabricator—efficient, safe, economical and long life performance is assured.

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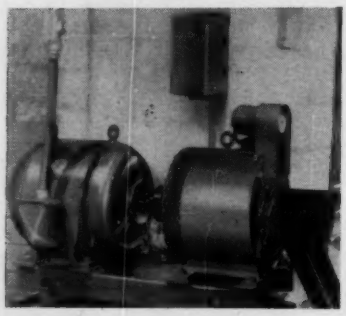
Pushbutton Enclosure

Oil-tight, seals out foreign materials.

Where liquids and dirt are a problem there is available a new oil-tight pushbutton enclosure fabricated from 14 gage steel. Costing much less than the conventional cast aluminum boxes these enclosures are of all-welded construction.

Openings for the push buttons are shaped to accommodate any standard make control unit while retaining an oiltight seal. Conduit connections may be any desired size and at any desired location. Cover with a sponge neoprene gasket can be swung open or removed from the box readily.—**Hoffman Engineering Corp., Anoka, Minn.** 272A



Adjustable-Speed Drive

Controls speed within plus or minus 2%.

The new Ampli-Speed drive can be coupled or belted to an existing motor to control speed of fans, compressors and centrifugal pumps within ±2%. Also it can handle constant torque loads.

Drive consists of a constant-speed "ring member" direct connected to the drive shaft of the motor. A variable-speed "magnet member" mounted on the output shaft turns the load. There is no physical connection between these two members.

Magnetic force between the magnet member and the ring member is varied to change the output speed of the drive. This is controlled by a magnetic amplifier connected to the rectifier supplying field excitation. During steady-state operation, feedback from a tachometer generator on top of the drive keeps load speed within the ±2% tolerance of control knob setting.

Ampli-Speed drives are available for motor speeds of 870, 1,150 and 1,750 rpm. For fan-type loads units are rated up to 95 hp.; for constant torque loads up to 75 hp.—**Electric Machinery Mfg. Co., Minneapolis 13, Minn.** 272B

Chemical Motor

Is self cleaning to reduce maintenance.

Outstanding feature of the new Marathon chemical motor is the self-cleaning effect of the air stream above the motor, it is said. Air is blown along ribs on the frame that increase dissipation of heat. There are no ducts to clog. Sticky or oily dirt can be removed from between the ribs without stopping the motor.

Frame is constructed from heavy cast iron that resists moisture and most chemicals. Explosion-proof frames have UL-approved continuous drain plugs.

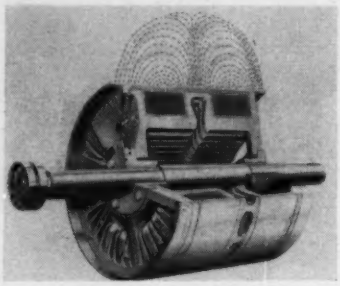
Heavy cast-iron conduit box is split diagonally so that leads are easily accessible. All leads are sealed where they enter the box.—**Marathon Electric Mfg. Corp., Wausau, Wis.** 272C

Variable Speed Motor

Will handle wide range of applications.

Now being manufactured under an English license the N-S variable speed a.c. motor eliminates need for mechanical variable-speed transmission. Efficient, safe electric controls have been substituted for mechanical drives. Controls can be provided for manual, semi-automatic or completely automatic operation.

Motor is adapted to high starting torque loads. It is claimed to maintain high efficiency under conditions ranging from sudden stops to reversing or inching. Models are available from 0.5 to 1,000 hp. with speed ranges from 30:1 to 1.5:1.—**Bogue Electric Mfg. Co., 52 Iowa Ave., Paterson, N. J.** 272D



Magnetic Pulley

Produces better flux pattern with two-coil design.

On many conveyor operations the new two-coil electro-magnetic pulley removes more tramp iron than larger units. Many applications can be handled by a two-coil pulley of smaller diameter than a three-coil pulley. Both equipment and power costs are reduced thereby.

It is claimed that the new two-coil design produces a more effective flux pattern with a deeper magnetic field at the center of the pulley. Such a pattern conforms to normal conveyor load conditions.

New pulley is available in a variety of widths and diameters from 12 to 60 in.—**Stearns Magnetic, Inc., Milwaukee 46, Wis.** 272E

Rerated totally enclosed fan cooled motor in 1 to 5 hp. sizes meets all NEMA requirements. Also features practically indestructible aluminum rotor, six-layer insulation of stator windings and fan that ventilates well rotating in either direction.—**Century Electric Co., 1806 Pine St., St. Louis, Mo.** 272F

Open drip-proof motors run cooler because extra aluminum turbine fan is mounted on motor shaft. Four fold increase in air circulation results. Also, internal design and construction transfers heat rapidly.—**ACEC Electric Corp., 40 East 49th St., New York 17, N. Y.** 272G

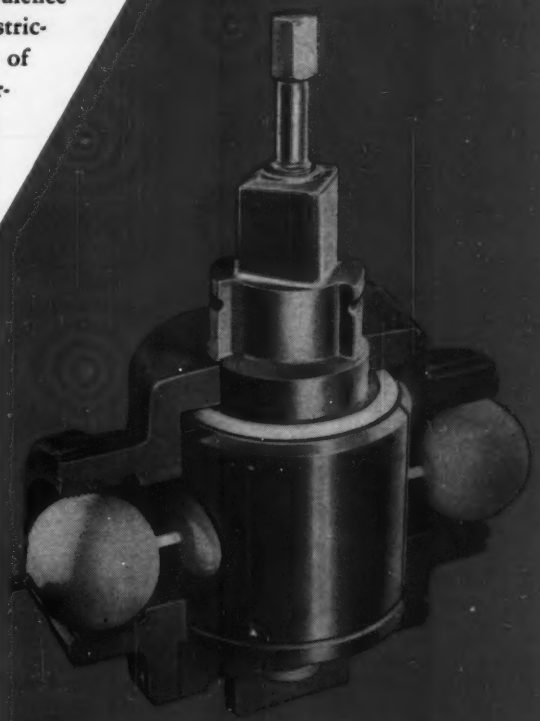
NO FUNNEL ACTION

because both acf Regular Round and acf Rectangular Port Valves have port areas at least equal to the pipe itself. Result: no turbulence to flow of viscous ladings and no restrictions to cause abrasion . . . no loss of head pressure . . . all highly desirable features throughout the processing industries.

Other important features are quick, quarter-turn shut off and Teflon* head seal gaskets, resulting in substantially lower maintenance costs.

Representatives in 50 Principal Cities are ready to show you how to keep down valve maintenance costs. Write for Catalog 5, CM-11, Valve Division, acf Industries, Incorporated, 1501 E. Ferry Street, Detroit 11, Michigan.

*DUPONT TRADE NAME



acf CYLINDRICAL FULL PIPE AREA PLUG VALVES

Bulk Storage Unit

For free-flowing materials.

Fabricated in one unit mounted on four legs, a new all-steel bulk storage unit is available in 10 or 25 ton capacities. It is designed for fertilizer, cement minerals, rock phosphate and similar bulk solids.

Unit has hopper bottom with a swing gate for controlling discharge effectively. Bin is made of 12 gage steel with a 16 gage steel top.

On top is an 18-in. manhole and cover for loading. For easy access a ladder leads down inside the bin.—**Andrews Machine Co., 359 East Main, Decatur, Ill. 274A**

Container Lining

For protection against corrosives, can be installed by hand.

All you need to install the new Fluorolin 202 lining are shears and a straight edge. It protects metal containers against corrosive chemicals.

The new material combines the chemical inertness of Kel-F with the mechanical rigidity of aluminum foil. Linings can be cut out, assembled on the job and pressed into place like wallpaper. Pressure-sensitive adhesive on the foil backing holds it in place. Joints may be butted and sealed with strips of the same material.—**Joclin Mfg. Co., North Haven, Conn. 274B**

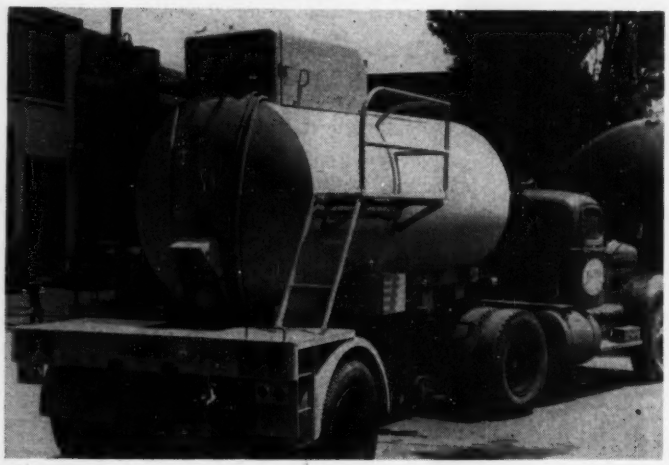
Tractor Shovel

For in-plant handling of bulk materials.

Recently added to the Michigan line of rubber-tired tractor shovels is a 15-cu.-ft. unit for in-plant handling of bulk materials. Featured in this model 12B is a power-shift transmission, a torque converter with 3 to 1 multiplication, a planetary wheel axle and low-level bucket action.

Particular attention has been paid to protect against dust. A filter is provided for both the torque converter oil and the power shift transmission oil. A partial flow filter protects engine lube oil. Transmission, torque converter, starting motor, distributor and generator are all sealed.

Bucket width is 4 ft. 2 in. and the 15 cu. ft. capacity will handle 1,500 lb. while traveling 5.6 miles per hr. Tractor features low-level bucket action with a 38 deg. tip-back at a carrying height of four inches above the ground. At maximum dumping height of five feet the bucket reaches an angle of 48.5 deg.—**Construction Machinery Div., Clark Equipment Co., Benton Harbor, Mich. 274C**



Glassed Steel Tanker Hauls Corrosives

Engineered throughout for safe handling of lading, this 2,200-gal. glassed steel tanker carries alkalis to pH 12 and all acids except hydrofluoric. Bottom outlet for tank washout is located conveniently near the rear platform, is sealed with beveled Teflon plug capped with a bolted steel flange. A protective shield locks the outlet assembly. Sliding hood atop tank houses the manhole and vent. Dip pipe for loading and unloading extends into sump at bottom. Vent has a pressure relief valve. —The Pfaudler Co., 1000 West Ave., Rochester 3, N. Y. 274D

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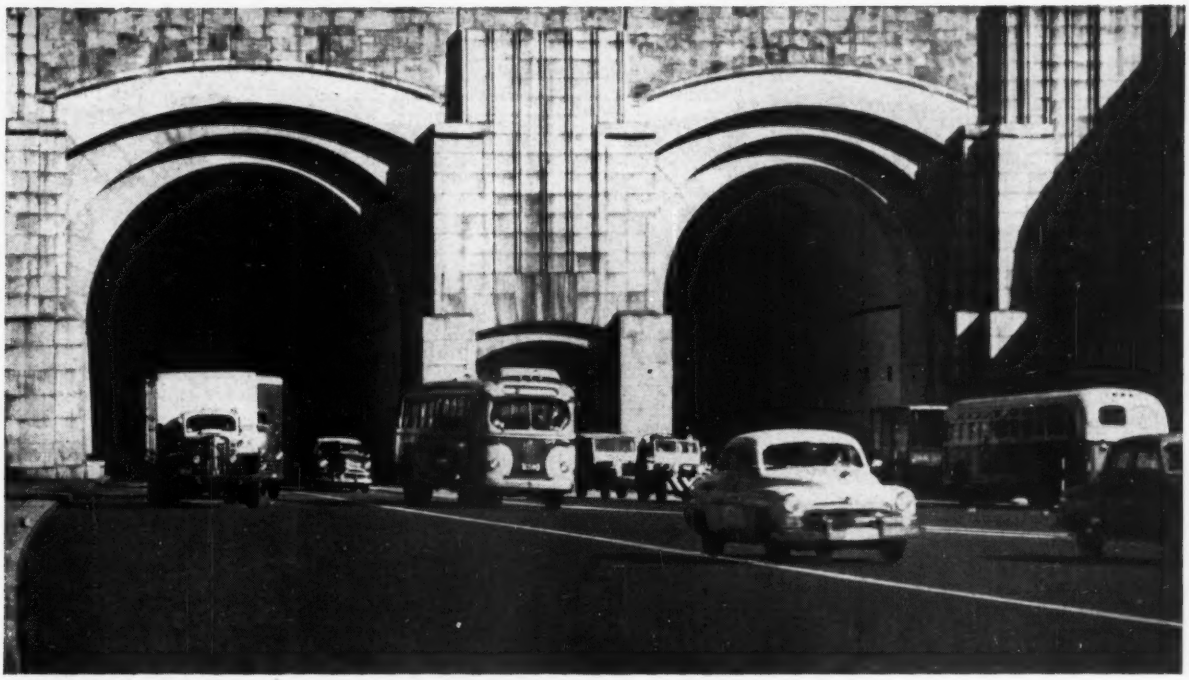
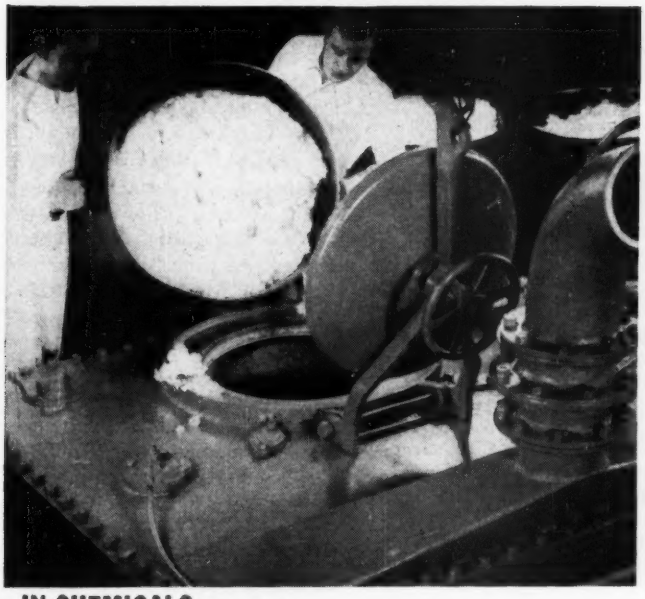
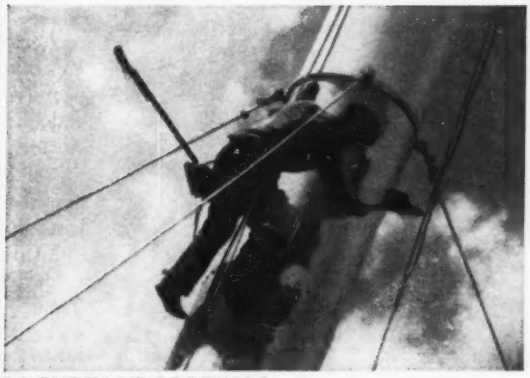


IN PETROLEUM *(Motor Oil and Gasoline Additives)*



IN CHEMICALS *(Plastics)*



IN SURFACE COATINGS *(Paint, Varnish, Lacquer)*

PETROLEUM	SURFACE COATING	CHEMICAL
PARANOX	PETROHOL 91	PETROHOL 91
PARATONE	PETROHOL 95	PETROHOL 95
PARAFLOW	PETROHOL 99	PETROHOL 99
PARAPOID	JAYSOL	JAYSOL
PARADYNE	Secondary Butyl Alcohol	Iso-Octyl Alcohol
PARATAC	Secondary Butyl Acetate	Decyl Alcohol
PETROHOL	Isopropyl Acetate	Denatured Ethyl Alcohol
Methyl Ethyl Ketone	Acetone	Tridecyl Alcohol
Dewaxing Aid	Methyl Ethyl Ketone	Dicyclopentadiene
Ethyl Ether	Dicyclopentadiene	Isoprene
Isopropyl Ether	Ethyl Ether	Butadiene
Reference Fuels	Isopropyl Ether	Ethyl Ether
RUBBER	Naphthenic Acids	Isopropyl Ether
ENJAY BUTYL	Iso-Octyl Alcohol	Tetrapropylene
VISTANEX	Decyl Alcohol	Tripropylene
	Denatured Ethyl Alcohol	Aromatic Tars
		Benzene
		Acetone
		Methyl Ethyl Ketone

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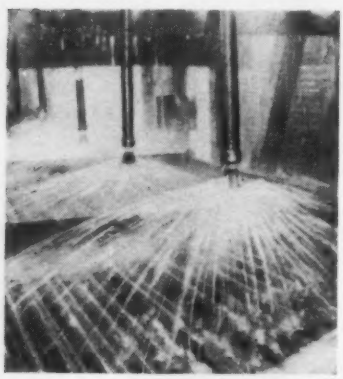
Forged Valves

Are lighter and stronger, resist wear.

A completely redesigned line of forged steel gate valves for petrochemical, process and power applications is available with either screwed or welded ends in sizes from ¼ to 2 in.

Major improvements include stainless-steel eyebolts and nuts, a redesigned stuffing box with sturdier gland and stainless steel follower, and a smoother-operating stem. Stuffing box packing of molded asbestos reinforced with wire and lubricated with mica reduces possibility of pitting the stainless-steel stem. A stainless-steel wedge and hard-chrome-plated stainless seat ring resist seizing, galling, and abrasive wear. – **American Chain & Cable Co., Inc., Bridgeport 2, Conn.** 276A



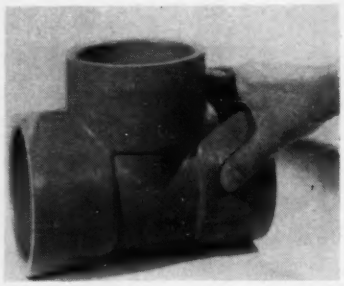
Spray Head

Distributes low pressure fluids evenly from discharge pipes.

Assuring an even pattern of wetting from the center out, the Gyrospray offers a number of advantages for distributing water in cooling towers, spray ponds and the like. While producing a controlled spray at pressures under 5 psi. it does not restrict flow from 1-in. feed pipe.

In cooling towers the spray pattern covers the width of a standard horizontal cooling section without water loss. On vertical coils dual baffle boards can be used to gain maximum efficiency. This allows air to circulate freely around tubes and totally eliminates blanketing and dampening effects.

All metal parts are stainless steel; rotor is molded nylon.–**N. C. Stearns Co., P. O. Box 1234, Shreveport, La.** 276B



Fittings

In 3- and 4-in. sizes molded of unplasticized PVC.

This 4-in. PVC tee is included in the first full line of 3- and 4-in. fittings to be injection molded in commercial quantities. These larger size fittings are expected to aid the economical erection of larger size PVC piping systems now being planned in the chemical, petroleum and allied fields. Initial cost of such systems is said to be less than piping of other materials usually employed where acute corrosion problems are encountered.

Fittings include 90 and 45 deg. elbows, tees, couplings and flanges. There is choice of threaded or socket types in normal or high-impact PVC.–**Tube Turns Plastics, Inc., 224 East Broadway, Louisville 1, Ky.** 276C

Exhausters

Fabricated of Haveg material to resist corrosion.

Blowers to move corrosive fumes through duct systems now are built with Haveg material to resist chemical attack. Type M has a housing molded completely from Haveg material; Type L has a cast housing lined with the Haveg material.

All the six-bladed blast wheels have a non-ferrous core coated with Haveg material. Bearing pedestals, housing supports and other parts not in contact with the fumes are made of steel coated with a corrosion-resistant paint.

Users can choose between Haveg 41 or 60 to handle fumes that are either acidic or basic. Wide range resistance to solvents also exists.–**Champion Blower & Forge Co., Lancaster, Pa.** 276D

Acid Hose

For highly corrosive acids.

New Hysunite hose is designed to handle heavy concentrations of sulfuric, nitric and chromic acids. Hose can carry sulfuric acid up to 96% concentration, nitric acid up to 70% and chromic acid up to 100%.

Conventional acid hose lasts but a few hours when carrying these acids. By contrast, extensive field tests show Hysunite hose has a months-long work life on concentrated acid service.–**Goodyear Tire & Rubber Co., Industrial Products Div., Akron, Ohio.** 276E

One-man operation of Saunders patent diaphragm valves in 10, 12 and 14-in. sizes now easy through a new planetary gear torque reducer. Either on new valves or those already in service it gives 5 to 1 mechanical advantage.–**Hills McCanna Co., 3025 North Western Ave., Chicago 18, Ill.** 276F

Heavy-duty stainless steel fittings now available from stock in threaded or weld ends for 2,000, 3,000, 4,000 and 6,000 psi. All fittings permanently identified with size, alloy, pressure rating, heat code and trademark.–**Camco Products, Inc., North Haven, Conn.** 276G

Sampling valve has seat that is outside body for installation where it's necessary that seat be inside wall of vessel. This prevents liquid from remaining in the nipple and valve, makes valve completely self-draining.–**Jerguson Gage & Valve Co., 80 Fellsway, Somerville 45, Mass.** 276H

to remove

H_2S

CO_2

use

Monoethanolamine

Diethanolamine

high purity
NITROGEN DIVISION
chemicals

NITROGEN DIVISION ALLIED CHEMICAL

Maximize the purity of your gas stream, and minimize corrosion problems by using Nitrogen Division gas-treating chemicals. Free of unwanted chemical impurities – chlorides and acids – these products are consistently above standard purity specifications.

Call or write today for samples and quotations. Ask too for technical service to help adapt these high purity chemicals to your process.

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to remove

H_2O

use

Diethylene Glycol

Triethylene Glycol

high purity
NITROGEN DIVISION
chemicals

Maximize the purity of your gas stream, and minimize corrosion problems by using Nitrogen Division gas-treating chemicals. Free of unwanted chemical impurities – chlorides and acids – these products are consistently above standard purity specifications.

Call or write today for samples and quotations. Ask too for technical service to help adapt these high purity chemicals to your process.

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- **863 Models** in three Basic Pressure Groups.
- **Capacities** from 2 cc. per hour to 15,000 gal. per hour.
- **Pressures** to 50,000 psi.
- **Mediums Handled.** Any liquid that will flow to the Pump—clear free-flowing, viscous, tarry materials and slurries—corrosive mediums such as acids, alkalies, salts, oxidizing and reducing agents, etc.
- **Capacity Control**—manual or automatic for proportioning in relation to temperature, time, flow, pH value, liquid level, pressure, color, conductivity or any other meterable factor.
- **Metering Accuracy** to two-tenths of one percent with automatic control mechanisms.

Now, no matter what your chemical proportioning problem—you will find the answer at PHILADELPHIA PUMP, "headquarters" for the most complete line of Controlled Capacity Pumps.

Advanced Design Offers Savings In First Cost and Maintenance

Pump users actually wrote the specifications for PHILADELPHIA PUMPS. For their design is the result of an industry-wide survey of pump users' practical experience on "what is wrong with the proportioning pumps you are using."

Simplification and standardization of basic features, and more efficient production methods, have answered the first complaint—High First Cost. Model for model, PHILADELPHIA PUMPS are lower in price.

Prevalent points of failure—cross-heads, connecting rod bearings, pressed valve seats, packing, etc.—have been corrected through advanced design and better materials of construction.

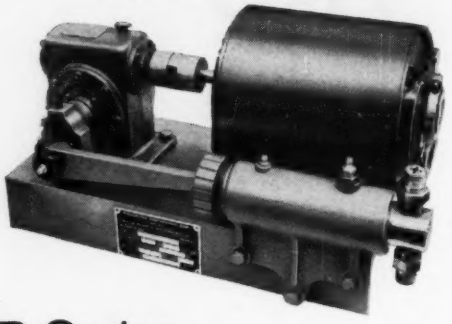
High Maintenance Costs—excessive down time and labor—have been eliminated by a design which permits the removal of all moving parts and packing through the oversize cross-head without breaking piping connections.

Proved by Years of Service In Leading Plants

Repeat orders testify to user satisfaction, and it is significant that engineers who know pumps best, men who purchase quantities of them annually for some of the largest plants—prefer PHILADELPHIA PUMPS.

It will pay you to investigate. Write for catalog.

Pressures to **800** psi

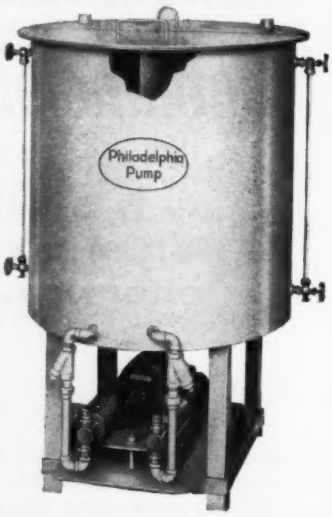


LP Series

The Phila-Feeder controlled capacity Proportioning Pump—a low cost, high quality pump popular for feeding water treating chemicals into steam boilers. Made in simplex and duplex types for maximum capacity to 18 gph. Adaptable to manual or automatic control.

Packaged Chemical Feed Units

PHILADELPHIA PUMP offers many standard and special designs of self-contained Units to meet all chemical feed requirements.



Unit illustrated is for feeding water treating chemicals. It comprises welded steel storage tank, Phila-Feeder duplex pump and all necessary auxiliaries and piping ready to connect to chemical feed piping and electrical circuits.

Other special Chemical Feed Units developed by PHILADELPHIA PUMP include:

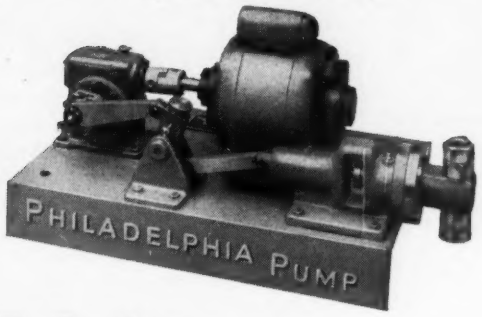
- Oil Well Chemical Treating Systems
- Natural Gas Odorizing Units
- Special Chemical Mixing & Proportioning Units

• *Sales Engineers in principal industrial centers in the United States, Canada, Mexico, and abroad.*

PHILADELPHIA

line of proportioning pumps

Pressures to **1500** psi

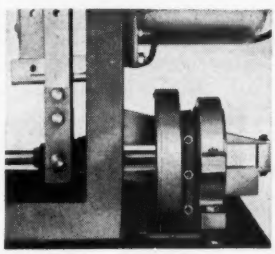


S Series

Made in simplex and duplex types for maximum capacity to 3300 gph. The standard proportioning pumps for most Processing Industry requirements and for treating of boiler water, municipal and industrial water, and sewage.

The pump illustrated is equipped with rocker-arm micro-adjustment of pump capacity while running.

The PHILATROL Automatic Control



This patented control mechanism for exceedingly accurate proportioning in relation to any meterable factor, adjusts piston stroke and hence pump capacity in response to manual, hydraulic, pneumatic or electrical motivation. It permits continuous stepless adjustment from zero to maximum and eliminates the "hunting" characteristics of other mechanisms with coarser adjustments.

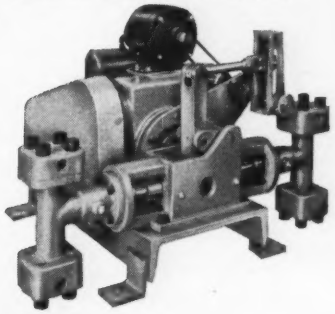
Illustrated is Philatrol Mechanism installed with air actuator on PHILADELPHIA PUMP used in gas odorizing. This pump has maintained metering accuracy within plus or minus two-tenths of one percent.

The UNI-FEEDER Automatic Control

Uni-Feeder single-revolution-clutch operated PHILADELPHIA PUMPS inject one or as many as 72 or more measured slugs of fluid per minute according to a time cycle or flow, color, concentration, or any other meterable factor.

Uni-Feeder Pumps are available with minimum capacities from .000093 gallons to maximum capacities of 27 gallons per minute.

Pressures to **50,000** psi



HP Series

These PHILADELPHIA PUMPS, designed for higher viscosities and pressures, are available in simplex, duplex and quadruplex types and in capacities from 2 cc. to 15,000 gph.

Like all PHILADELPHIA PUMPS, they are adaptable to both manual and automatic control of capacity.

The design of these pumps offers mechanical advantages which permit reduction in horsepower normally required by as much as 30 percent.

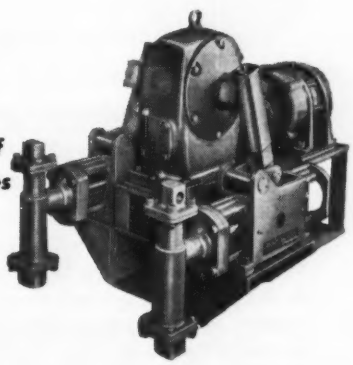
Differential Pressure Pumps

PHILADELPHIA PUMPS of the HP Series also offer a design feature which permits them to utilize the energy incorporated in any suction pressure to decrease the amount of horsepower required to produce the desired discharge pressure.

For example, if suction pressure is 2000 psi and discharge pressure is 3000 psi, the pump requires powering only for the differential pressure of 1000 psi, plus a small addition for friction losses. Consequently, great savings in first cost (motor, gear reducer, etc.) and operating cost can be effected.

See Our Exhibit at the 25th Exposition of Chemical Industries

December 5-9 1955



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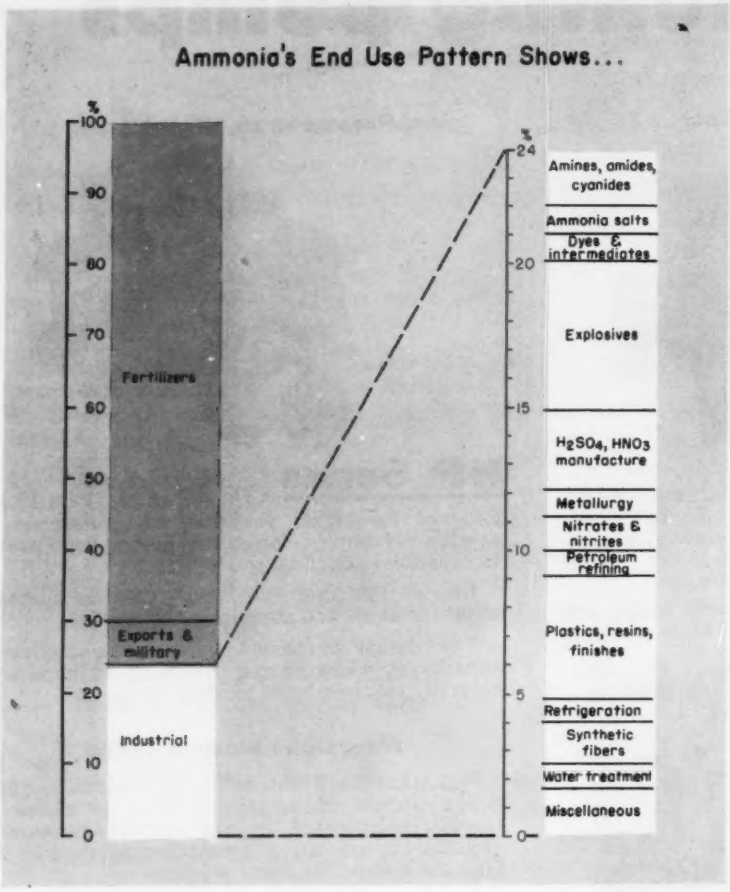

Why Nitrogen Keeps Booming

Undeniably, fertilizers are the mainstay. But the rise of many more uses gives needed depth to the spectacular, far-from-over growth of nitrogen chemicals.

Richard P. Windisch, W. E. Burnet & Co.

One of the most far-reaching chemical developments since World War II has been the growth in the use of nitrogen and its compounds, particularly ammonia. Spreading beyond the old-line chemical companies to oil, steel and public utilities firms, it still seems to be gaining momentum.

▶ **Fixation the Key**—Although the older sources of nitrogen chemicals—Chilean nitrates, coke-oven byproducts and cyanamide—continue to make progress, synthetic ammonia by nitrogen fixation is rapidly taking over the market.

In 1939 U. S. production of atmospheric nitrogen totaled 311,000 tons, 85% of it made by two companies at two plants. By the end of last year our capacity had grown to 2.77 million tons, spread out among 21 companies at 34 plants. At least 18 more companies plan or have already completed new plants (*Chem. Eng.*, Sept. 1955, p. 270) and these, plus expansion by existing producers will raise total capacity to nearly 4 million tons/yr. Yet so far there's little sign of over-production.

And we see at least a 6-10 million ton/yr. consumption before the development matures.

Ammonia production has undoubtably grown faster than any other basic inorganic chemical since World War II began. Annual dollar volume has already passed those of caustic soda, chlorine and soda ash and is even approaching that of sulfuric acid.

The number of chemical and oil companies involved makes future trends of the industry vital to investors. (Petroleum firms, on the basis of present plans, will soon own nearly 40% of U. S. ammonia capacity.) The economics of ammonia are going through a revolution and the marketing of a host of new products made with cheap nitrogen is going to be of huge consequence to many chemical process industries.

▶ **Nitrogen in Nature**—Far and away the biggest use of nitrogen is in fertilizers—70-75% of all produced. In the U. S. we now add about 2 million tons/yr. of nitrogen to the earth in the form of nitrates and various ammonia compounds.

But we're fast dropping behind since about 10 million tons/yr. are lost through leaching and erosion of the soil alone. To maintain present needs we should add at least the 6.65 million tons lost—the difference between the 22.9 million tons removed annually and the 16.25 million tons returned through farming activity.

Look at these examples of what fertilizers can do: By applying 259 lb./acre of fertilizer instead of the 19 lb. now applied, our annual

RICHARD WINDISCH *is chemical investment consultant with W. E. Burnet & Co., New York stock brokers.*

REVERE COPPER
ideal for distillation columns

These photographs show three distillation columns fabricated by American Copper & Brass Works, Cincinnati 2, Ohio, for a customer in a foreign country. They are made of Revere Copper Sheets and Circles. All told, 4608 pounds of copper were required. The columns will be used to distill high-proof alcohol, either beverage or industrial.

Longitudinal seams were welded. Flanges were produced by simply turning the metal over to the required dimension. Copper, you see, is extremely easy to work. In addition, it does not react with alcohol and a wide variety of other liquids and gases. Copper also can be quickly and economically welded by modern methods, and if you wish, the Revere Technical Advisory Service will be glad to show you how to do a fast and sound welding job on copper sheet and plate. See the nearest Revere Sales Office.

Two views of three copper distillation columns by American Copper & Brass Works, Cincinnati. The large holes will be closed by removable plates, for inspection and cleaning.

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wheat needs could be produced on half the acreage now used and for 80¢/bu. instead of today's $1.00/bu. Recent tests in California showed that the grass growing season can be extended for two months and meat yields per acre more than doubled by proper use of nitrogen. This state alone could profitably use a million more tons of nitrogen annually.

Our annual nitrogen loss indicates that output of nitrogen for agriculture alone could double or triple economically. And barring inflation, nitrogen's price should decline as output and technology multiply. As it is, fertilizer prices in terms of plant food content have risen only 13% since 1935, while all items the farmer buys are up 125%.

Distribution expense and uneven seasonal demand will probably be the industry's biggest problems for a long time. About 70% of all fertilizer is applied in the first half of the year. Higher concentrations are cutting transportation costs, but fertilizers will always be an "area chemical," made near the point of use.

▶ **The Ways Out**—Seasonal demand and storage expense are great incentitives toward balancing ammonia's agriculture use with industrial uses. And broader markets involve higher-margin products.

It's much more desirable to sell nitrogen at say 50¢ or more per lb. as fine chemicals than as liquid ammonia at $85/ton, ammonium nitrate at $70, or even urea at $110/ton (roughly 5¢, 10¢ and 12¢/lb. of contained nitrogen). Nitrogenous products are being developed for practically every industry and many offer tonnage prospects.

Two products with big potentials are ammonium hydroxide and nitric acid, both held back by their high prices. With a little drop in price, the acid, for instance, would give our big industrial acids, sulfuric and hydrochloric, great competition.

▶ **Many Possibilities**—To give you a qualitative idea of the non-fertilizer nitrogen markets, there follows an outline of the process industries now using it and the possibilities for new uses. Urea and nitric acid, the two most basic intermediates, will find big outlets in organic synthesis on any price decline.

Urea is stable and easily shipped. Nitric acid, though, is so expensive to ship and so easily made by burning ammonia that it's more likely to be made on the spot by big users. Other nitrogen intermediates like hydrazine, cyanides, amines and amides require such a lot of production knowhow that manufacture will likely stay in the hands of ammonia producers and large chemical firms.

▶ **Explosives**—Nitrates have from time immemorial been the basis of most military and commercial explosives. Today about 24% of U.S. industrial nitrogen* goes into explosives. A host of nitrated organics are custom-made to perform the various military jobs of detonating, disrupting and propelling. Dynamite's active ingredient is nitroglycerine, basis for most commercial explosives. Many possible fuels for jato, rockets and guided missiles are nitrogen compounds, such as hydrazine, ammonium chlorate and nitric acid.

▶ **Plastics**—Potential here is excellent both as basic ingredients and as plasticizers and curing agents. About 18% of industrial nitrogen now goes into plastics.

The world's first plastic, nitrocellulose, lost out as celluloid and photographic film because of its flammability, but still enjoys big sales in auto finishes and lacquers. Urea-formaldehyde resins are in wide demand because of their brilliant colors. Melamine resins are in high favor for dishes.

On the horizon, American Cyanamid and some German firms are developing a wholly new series of nitrogen-containing plastics called triazines. When copolymerized with other resins the product stands temperatures up to 500 F. Fatty acid amides by General Mills and Armour have remarkable effects when blended with epoxy resins. And Union Carbide has a new amine series for curing epoxy plastics.

▶ **Metallurgy**—Ammonia is gaining tremendous use in bright annealing of steel, in sintering powdered metals and in galvanizing. It provides a dry reducing gas and prevents oxidation at the high temperatures used. It's also being used in growing volume in nitriding and surface hardening of special steels. Nitriding of refractory elements like tungsten and boron has great promise in the field of jet engines and turbines.

Nitric acid pickles stainless steel, and ammonia is successfully ex-

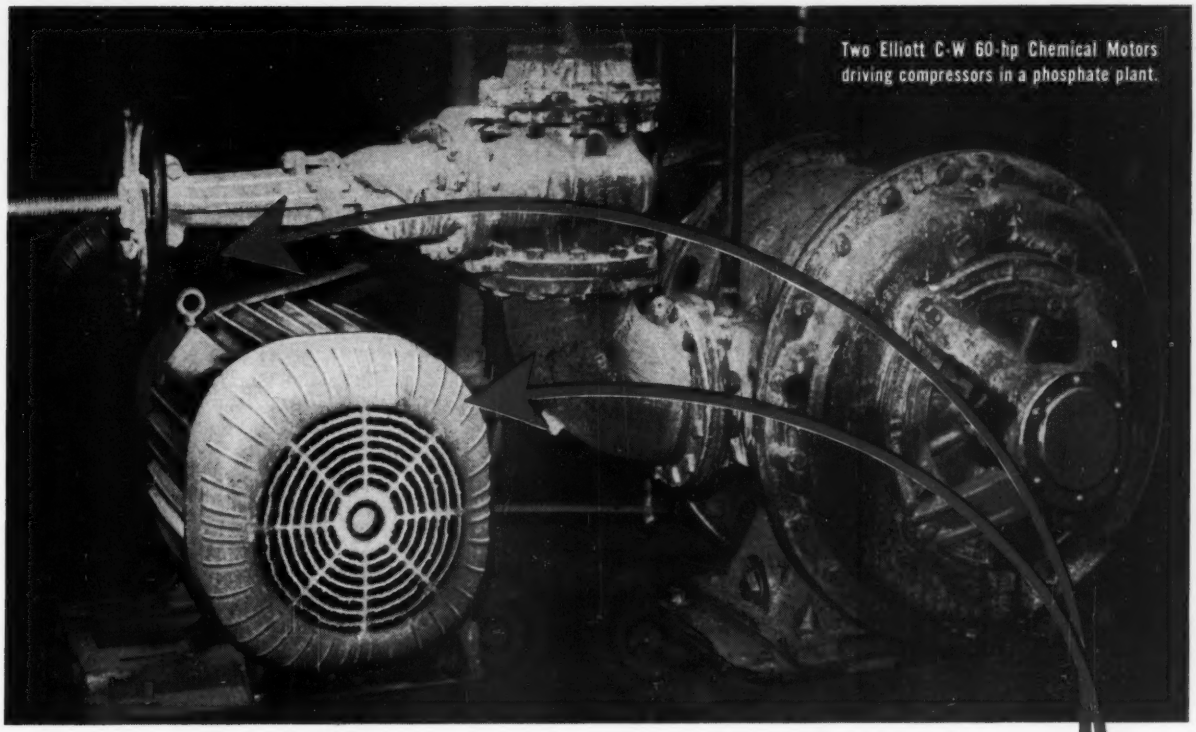
*All nitrogen recovered by fixation except that used in fertilizers, by the military and exported (*see chart, p. 280*).

INDEXES
(1935 = 100)

Business Activity	**Aug. 1955**	**312.7**
Chemical Consumption	**June 1955**	**288.7**
	May 1955	**311.0**
	June 1954	**267.5**

Chemicals by Industry

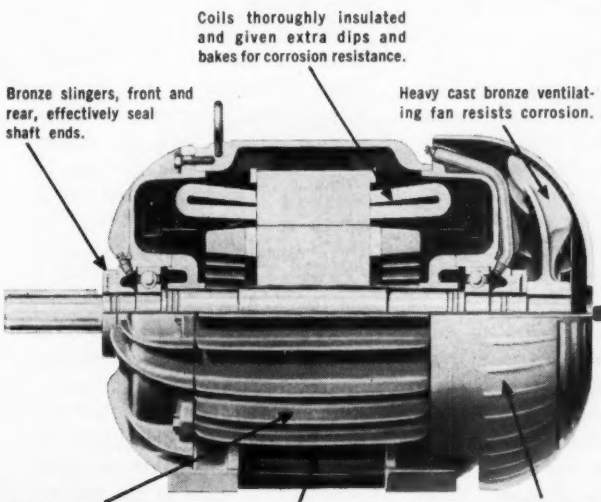
	July (Prelim.)	June (Rev.)		July (Prelim.)	June (Rev.)
Fertilizer	31.37	47.78	Textiles	8.47	10.17
Pulp & paper	32.35	35.66	Coal products	11.76	11.96
Petroleum refining	30.56	29.20	Leather	4.45	3.94
Iron & steel	16.69	17.88	Explosives	8.60	9.87
Rayon	29.12	29.75	Rubber	6.24	7.80
Glass	26.23	26.98	Plastics	18.89	21.68
Paint & varnish	29.95	36.00	Total	254.68	288.67



Two Elliott C-W 60-hp Chemical Motors driving compressors in a phosphate plant.

Process service can be tough on motors!

Get maximum protection with ELLIOTT chemical motors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ELLIOTT Company

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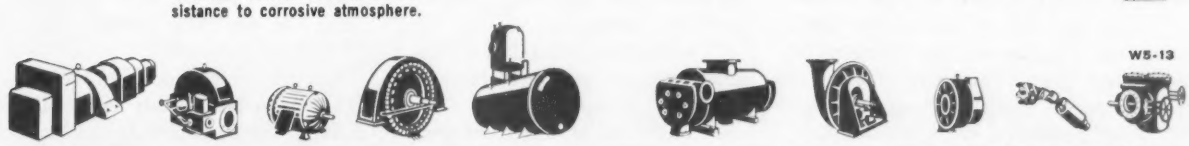
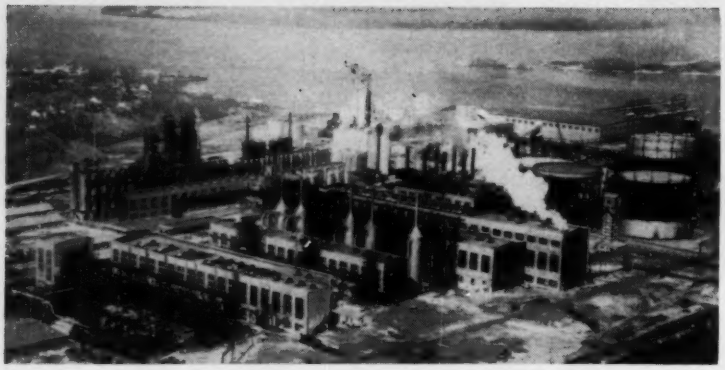


TURBINE-GENERATORS · TURBINES · MOTORS · GENERATORS · DEAERATING HEATERS · EJECTORS · CONDENSERS · COMPRESSORS · TURBOCHARGERS · TUBE CLEANERS · STRAINERS



WORLD'S BIGGEST ammonia plant: Allied's Nitrogen Div., Hopewell, Va.

tracting nickel, cobalt, beryllium and zinc from their ores. Fatty acid amines are important in mineral flotation processes.

▶ **Pulp and Paper**–Partly to combat pollution, five western mills have gone to ammonium bisulfite pulping instead of calcium bisulfite and claim better quality and efficiency. The French and Germans have a way to make pulp from hardwood with nitric acid instead of sulfite. Melamines are used in volume to make wet-strength papers.

▶ **Rubber**–The multitude of rubber accelerators and antioxidants now use millions of pounds of aniline yearly. GR-N, the oil-resistant synthetic rubber, is made from acrylonitrile. Polyurethanes made from isocyanates are being actively developed by many firms, particularly Monsanto, Goodrich, Allied and Du Pont.

▶ **Textiles**–Two large, growing classes of synthetic fibers contain nitrogen–polyamides (nylon) and acrylonitrile polymers (Orlon, Dynel and Acrilan). Ammonia is basic to all these, and nitric acid is used to make terephthalic acid, the Dacron intermediate.

Monsanto and American Cyanamid are working to improve cotton quality by cyanoethylation. Urea-formaldehyde resins are the basis of crease resistance. The British are working on a new fiber based on hydrazine and the Germans on one from isocyanates. And, of course, nitrogen-containing dyes are numbered in the hundreds.

▶ **Food**–Nitrogen, a basic food constituent, plays a big role in this field. The amino acids, methionine and lysine, made synthetically from ammonia by Du Pont, Merck and National Distillers, cost $3 and $6/lb., but will have big use when mass-produced. Over 6 million lb./yr. are fed to poultry. Dow is also making amino acids. Directly fed urea is highly efficient in fattening cows and sheep.

Nitrogen dioxide is important in flour bleaching and both sodium nitrate and nitrite play a big part in meat processing. Several amines are useful reagents and solvents in the leather, glue and gelatin trades. Ammonia salts stimulate yeast growth in beverage fermentation. Nitrogen provides food for bacteria, thus helps build many complex organic molecules.

▶ **Drugs**–Poundage use of nitrogen here is small, but profit margins are wide and the range of usage tremendous–from smelling salts to vitamins, from sporifics to sulfa drugs, antituberculars and tetracycline. One big success has been Norwich Pharmacal's development of 300 nitrofuran compounds, many medically unique.

▶ **Miscellaneous**–Without detail, here's a partial list of the many other nitrogen uses:

- Quaternary ammonium salts are a small but important group in synthetic detergents.
- Most agricultural pesticides, fumigants and sterilizers contain at least one nitrogen group.
- 10-12% of U. S. refrigeration still uses anhydrous ammonia.
- Tons of ammonia go into neutralizing the chlorine in water purification and the acids in oil refining.
- Hopes are high for the nitroparaffins being developed by Commercial Solvents and Olin Mathieson's hydrazine derivatives.

▶ **What Firm Will Lead?**–Nitrogen's boom may just be starting. Its abundance may open a chemical proliferation that will far exceed those of chlorine and phosphorus. While the success of Dow, Hooker and Mathieson came via chlorine, and of Monsanto, Victor and Blockson via phosphorus, today's big question is who's going to be the nitrogen champion. One thing's sure, the battle will be won in the fields of agricultural marketing and upgraded derivatives where knowhow will be essential.

▶ **Danger in Plant Food**–Farm prosperity–natural or artificial–will always be the foundation of the nitrogen industry. And the plant food market, because of its potential size and essentiality, has always intrigued chemical makers. But it probably has also wrecked more chemical companies than any other market.

Union Carbide and Diamond Alkali are the only big chemical firms that have completely refrained from going into nitrogen fixation, though both use ammonia. Monsanto just got in by acquiring Lion Oil. Du Pont, which used to have 35% of all U. S. capacity, has made no effort to expand. By the end of 1956 it will have only 6% of total capacity.

Until very recently none of the big powder companies showed much interest in building a captive supply of their most important raw material. Though they supply the bulk of U. S. commercial explosives and had most of the nation's nitrating experience, they were so disinterested in 1940 that the government had to build 10 ammonia plants at a cost of $200 million. After the war these brought only 25-30% of their cost.

Hercules finally bought one of the government plants last year. (Others were taken by Allied,

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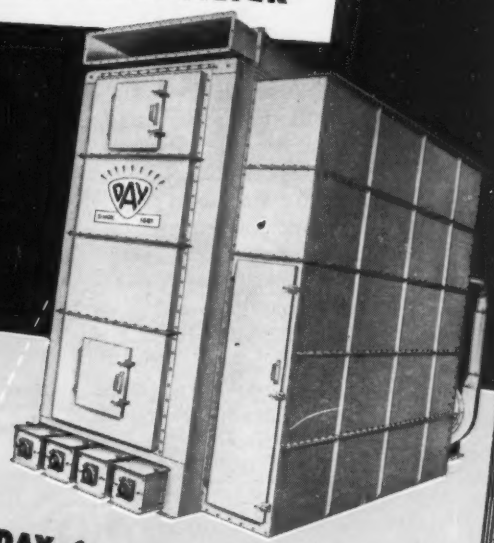

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Spencer (2), Lion Oil, Phillips, Mathieson (2) and Commercial Solvents.) Hercules also owns half of the Ketona Chemical plant in Alabama that will use coke-oven gas as a hydrogen source (see p. 110). Atlas says it may build an ammonia plant, and Cyanamid built one last year at Avondale, La.

Allied, Mathieson and recently American Cyanamid are the only broad-based, old-line chemical companies who seem to have recognized that nitrogen and its principal carrier, ammonia, are about to become basic staples with a breadth of use that rivals soda ash, chlorine and even sulfuric acid.

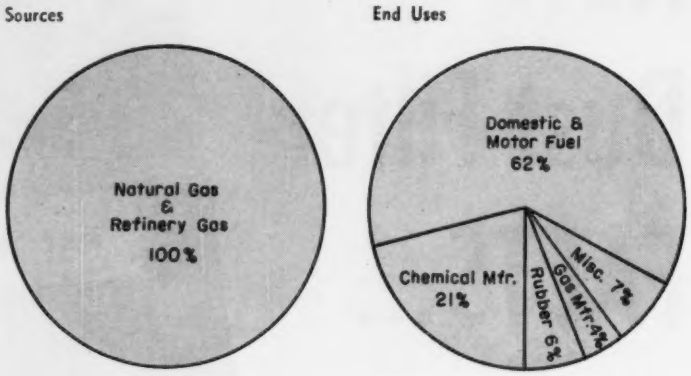
The only explanation we have is that several big firms seem to have formed definite policies against investing in basics, partly because of the high investment required, preferring to buy them and divert available capital into specialties and chemical end products.

▶ **Today's Picture**–Spencer saw ammonia's potentials early and got two of the government's choicest locations. It has developed these so successfully that in 1954 it netted a greater return on sales than any other chemical company on the New York Stock Exchange. Mathieson was quick to take the Lake Charles, La., government plant and later leased one at Morgantown, W. Va.

The three other big ammonia enthusiasts are Shell, Phillips Petroleum and Allied. Shell was first to make it from natural gas–25 years ago. Once postwar economics definitely threw the balance in favor of petroleum gases, Shell began actively campaigning to promote agricultural uses of anhydrous ammonia, such as use in irrigation water and direct application to the soil.

Allied, the leader since 1926, is still the battle-scarred champion, but nitrogen products now make up only 17% of its total sales. Under new postwar management and with big, well-located plants, Allied has again taken up the nitrogen flag in a big way. Much of its recent expansion has been devoted to better ways of serving nitrogen to the consumers.

Liquefied Petroleum Gases, 1954 (5.13 million gal. sold)



Watch the Big Hydrocarbons

New technology in propane, butane and higher hydrocarbon derivatives demands you study these petrochemical raw materials, the last ones in our series.

C. J. Matthew, R. F. Messing and R. L. James, Arthur D. Little, Inc.

For many, the word "petrochemicals" conjures up thoughts of products derived from natural gas or ethylene, such fast-growers as ammonia and polyethylene. But the higher hydrocarbons–like propane and benzene–are also prime chemical sources.

Take propylene-derived glycerine, for instance. A new Shell process and a big new Dow plant stirred up a lot of interest earlier this year. The Shell process stirred up some speculation, too–are there enough markets to use the by-product acetone produced?

▶ **Let's Look at Propane**–Third in the series of important hydrocarbons used to make petrochemicals is propane. Its most common form, of course, is in liquefied petroleum gas (LPG), primarily a propane-butane mixture. This material is the base for production of oxidation chemicals such as those made by Celanese at Bishop, Tex.

Total LPG sales in 1954 were about 5.1 billion gal. Domestic and motor fuels accounted for about 62% of the total LPG market, followed by chemical manufacture–about 21%.

Where Our Petrochemical Series Stands

I. Growth, Methane & Derivatives
II. Ethane, Ethylene & Derivatives
• III. Propane, Butane & Derivatives, plus Higher Hydrocarbons

Here's the last section of our three-part roundup on petrochemicals.

It was based on a paper by Chris Matthew before the annual symposium of the Chemical Market Research Group of Southern California, May 19, 1955. You'll find Part I in the September 1955 issue on page 266, Part II in October on page 280.

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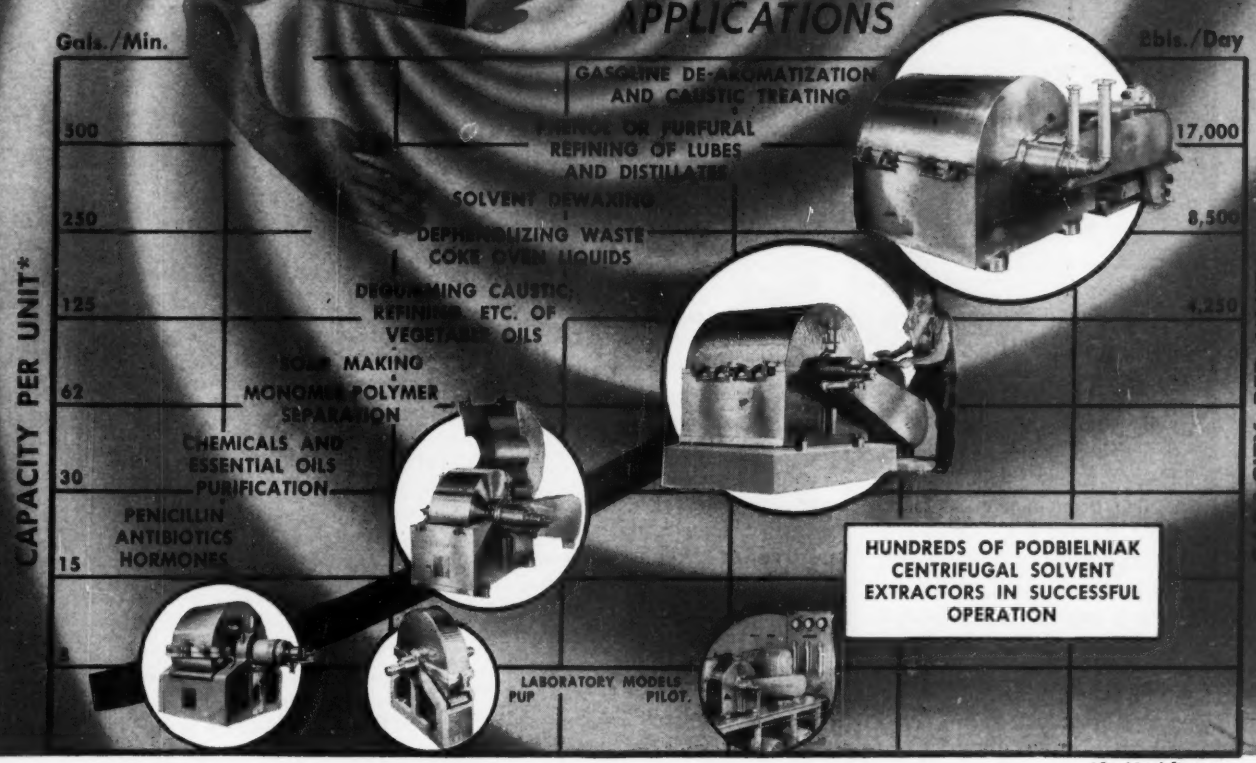

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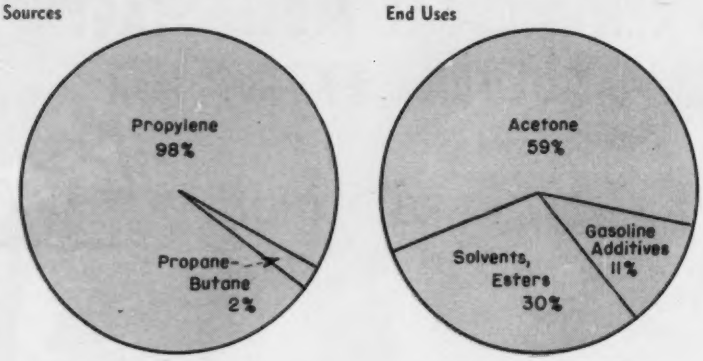
Isopropyl Alcohol, 1954 (859 million lb. produced)



Propylene derived from propane finds many uses analogous to those for ethylene. We discussed some of these last month (*Chem. Eng.*, Oct. 1955, p. 280).

Most important is conversion of propylene to isopropyl alcohol. Manufacture of IPA last year was 859 million lb., with Shell Chemical leading the field, followed by Esso and Carbide & Carbon. Acetone is the major derivative of IPA, accounting for 59% of total consumption.

▶ **IPA Weakened**—The isopropyl alcohol picture is weak for several reasons. First, acetone, which is influenced largely by rayon demand, has been in ample supply. This has resulted not only from a depressed textile situation, but also from a reduction in the general use of acetone as a solvent. Present acetone producers are also facing competition from the new cumene route to phenol which makes acetone as a byproduct.

Antifreeze market prospects for IPA are also declining since methanol is gaining increased stature as a volatile antifreeze.

▶ **New Glycerine Entries**—Another important outlet for propylene is in the manufacture of synthetic glycerine. Shell Chemical's present glycerine production is estimated at about 55 million lb./yr. This is 25% of the total U. S. production, with the rest derived as a byproduct from soap and fatty acid manufacture.

However, late this summer Dow Chemical put its 36-million-lb./yr. synthetic glycerine plant on stream at Velasco, Tex. Dow's process is very similar to Shell's.

Recently, too, Shell announced a new process for glycerine based on hydrogen peroxide and acrolein. Shell will probably build a 25-million-lb./yr. plant based on this technique.

Reportedly, Shell's process starts with proyplene being converted to isopropyl alcohol, which, in turn, will be oxidized to hydrogen peroxide and acetone (*Chem. Eng.*, June 1955, p. 104). This is an exceedingly interesting development since it is another nonelectrolytic approach to peroxide manufacture.

Acrolein, Shell's other new raw material for glycerine, will also be made by direct catalytic oxidation of proyplene. And it may well have some interesting uses as a starting block for other petrochemicals.

▶ **Too Much Acetone?**—Since its new nonelectrolytic process for hydrogen peroxide yields acetone as a byproduct, Shell will have an answer to the phenol-from-cumene producers who also recover byproduct acetone.

But with the acetone market depressed by the textile situation, there's some question as to where all this acetone can be used.

▶ **Propylene to Phenol**—One of the most interesting new outlets for propylene is in making phenol by the cumene process. Cumene is made by combining propylene and benzene. Then it's oxidized to phenol and acetone—the process used by B. A. Shawinigan, Oronite Chemical, Hercules Powder and the Barrett Division of Allied Chemical.

Again, though, the depressed acetone market casts some shadows on the future prospects of the cumene-to-phenol process as compared with chlorination and sulfonation routes to phenol. The economics of the cumene process depend considerably on the byproduct credit from acetone. Each cent reduction in the selling price of acetone reduces by approximately 0.6¢/lb. the profit advantage offered by the cumene-phenol method over the other two processes.

Propylene tetramer, or alkane, is another major market for propylene, taking nearly 200 million lb. of propylene in 1954. Oronite Chemical is the biggest supplier of alkane for detergent use throughout the country. Other important producers are Atlantic Refining, Continental Oil and Standard Oil (Ind.).

▶ **Butane Derivatives**—The two top four-carbon hydrocarbons are butylene and butadiene. In order of importance, the uses for butylene in the chemical industry are in the manufacture of butadiene, sec-butyl alcohol, butyl rubber and polybutenes.

Butadiene dominates the markets for all four-carbon products. It's made by removing hydrogen from normal butylene or normal butane. The butylene comes either directly from butane or from refinery gases. U. S. butadiene capacity in 1954 was about 800,000 tons. About 89% of production goes into GR-S synthetic rubber and it is also an important ingredient in other types of rubber, including nitrile.

Beside its rubber uses, butadiene is one of the intermediates going into resins for latex paints and leather substitutes. It is also one of the materials now used to make nylon. Du Pont runs a plant using this method at Victoria, Tex.

With the recent acquisition of government-owned butadiene

Announcing Podbielniak

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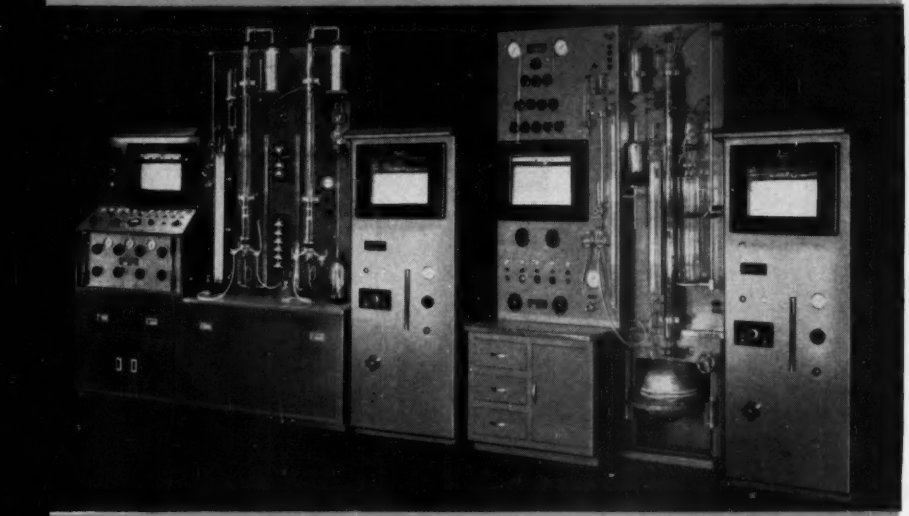

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HYPER-CAL
Automatic Recording High-Temperature Laboratory Distillation Apparatus with Coupled CHROMACON.

Other combination models available.

APPLICATIONS

For Primary Analysis: The CHROMACON, whether separate or combined, may be used for the rapid analysis of a great many mixtures, within the scope and limitations of the vapor phase chromatography method. Write for detailed information.

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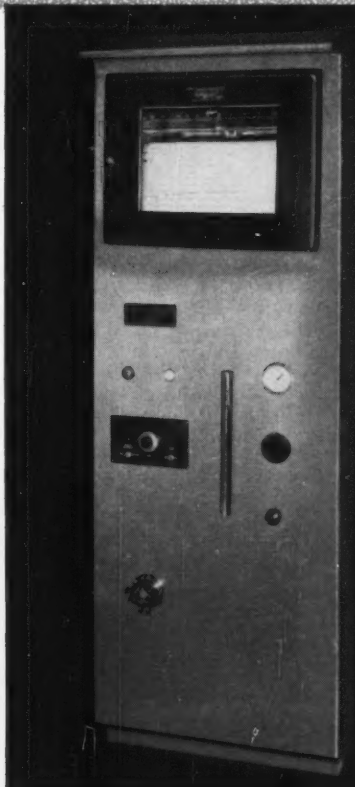
Supplementing High-Temperature Distillation: The HYPER-CAL is the most efficient and generally useful apparatus in the laboratory for analysis and separation of almost any material boiling from about —40°C. to 350°C. at 5 mm. Hg. abs., sample size ranging from 5 to 20,000 cc. The CHROMACON is a great aid in prompt "on-the-spot" processing of distillate fractions and in making separations of azeotropes, close-boilers, etc., inseparable by distillation.



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The CHROMACON comprises: three stainless steel chromatographic columns, with compression metal couplings, a special, high-sensitivity, low-holdup thermistor type thermal conductivity cell detector and circuits; a fluid-damped precision pressure regulator and needle valve to control flow of carrier gas; sampling section; an electrically heated thermostatted enclosure (to 160°C.) around the columns and detector cell; all necessary connections, gages, controls, etc. The special electronic recorder, as illustrated, has 1 sec. full scale pen travel, 1 mv. range, rapid chart travel.

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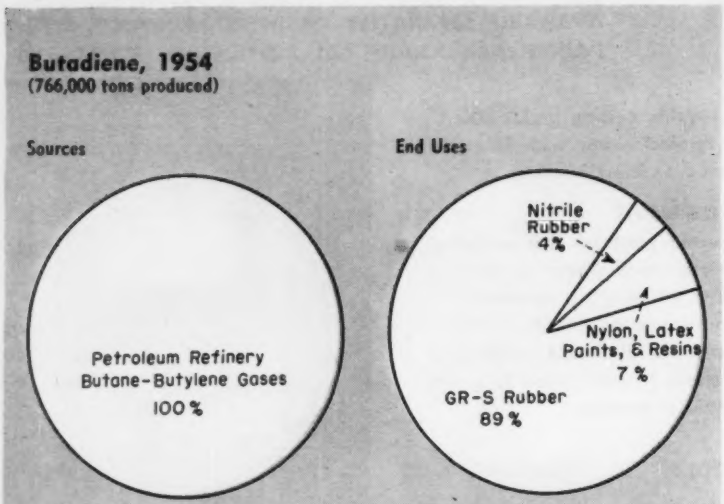
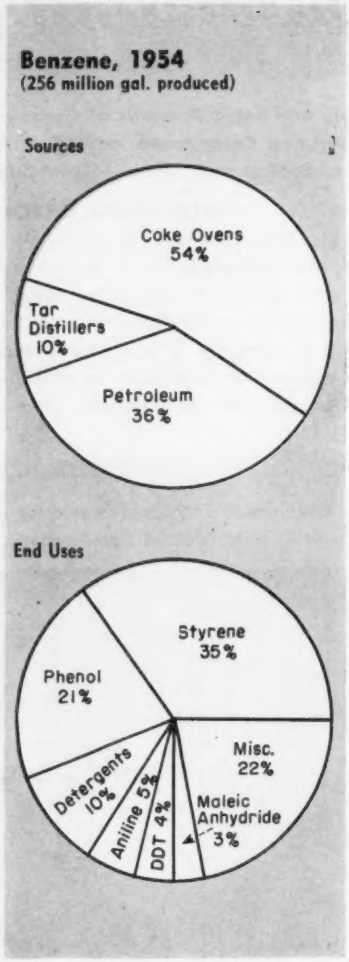


U. S. Butadiene Capacities, 1955

Producer	Location	Thousand Tons/Yr.
Hydrocarbon-Based—Total		631
Copolymer Corp.	Baton Rouge, La.	23
Dow Chemical	Midland, Mich.	8
Esso Standard Oil	Baton Rouge, La.	33
Humble Oil	Baytown, Tex.	49
Petroleum Chemicals, Inc.	Lake Charles, La.	60
Petro-Tex (Food Machinery & Tennessee Gas)	Houston, Tex.	78[1]
Phillips Chemical	Borger, Tex.	71
Shell Chemical	Los Angeles, Calif.	61
Standard Oil of California	Los Angeles, Calif.	—[2]
Texas Butadiene & Chemical	Houston, Tex.	43[3]
Texas-U. S. Chemical & Goodrich-Gulf Chemical	Port Neches, Tex.	197
Union Carbide	South Charleston, W. Va.	8
Alcohol-Based (Inoperative)—Total		215
Koppers Co.	Kobuta, Pa.	128
Publicker Industries	Louisville, Ky.	87[4]
Total		846

[1] Increase of 50% proposed
[2] Produces crude butadiene later purified by Shell, is therefore included in Shell's capacity
[3] Under construction, proposed ultimate capacity
[4] Leased from U. S. government



plants by private industry, we can expect considerable market development of the product. Also in the works is a proposed privately financed butadiene plant by Texas Butadiene & Chemical Corp. near Houston (*Chem. Eng.*, Sept., 1955, p. 118). Capacity will range from 17,000 tons of butadiene and 2.5 million bbl. of aviation gasoline a year, through increasing amounts of butadiene and decreasing quantities of avgas, to 43,000 tons of butadiene alone. Privately built butadiene facilities now in existence total 50,000 tons/yr. capacity and are owned by Esso (Baton Rouge, La.), Dow Chemical (Midland, Mich.) and Union Carbide (South Charleston, W. Va.)

Shell Chemical and Esso together account for over 90% of all U. S. output of sec-butyl alcohol, which was 210 million lb. last year. Principal uses for this alcohol and its derivative, methyl ethyl ketone, are in solvents for lacquers and paints and in petroleum refining for dewaxing lube oils.

Butyl rubber is used extensively for inner tubes because of its excellent ability to hold air without leakage. However, with the acceptance of tubeless tires, butyl markets are expected to decline even though there is some butyl used as a component of tubeless tires.

Polybutenes are rather viscous oils that have good adhesive characteristics. One of their largest uses—out of a total output of more than 30 million lb./yr.—is in improving the viscosity index of lube oils. Esso is the main factor in this business. Other uses for the polybutenes include rubber modifiers, textile lubricants and adhesives. Standard Oil of California and Standard Oil of Indiana are very active in these areas.

▶ **Higher Hydrocarbons**—Five-carbon hydrocarbons have much more limited chemical markets than the shorter-chain materials. The two main intermediates useful in chemical synthesis are isoprene, which is used in speciality rubbers, and cyclopentadiene, which is the base for the insecticide chlordane.

Hydrocarbons with six to eight carbon atoms are of most interest in the manufacture of benzene, toluene and xylene. Because of the rapid market growth for chemical-grade aromatics and the limita-

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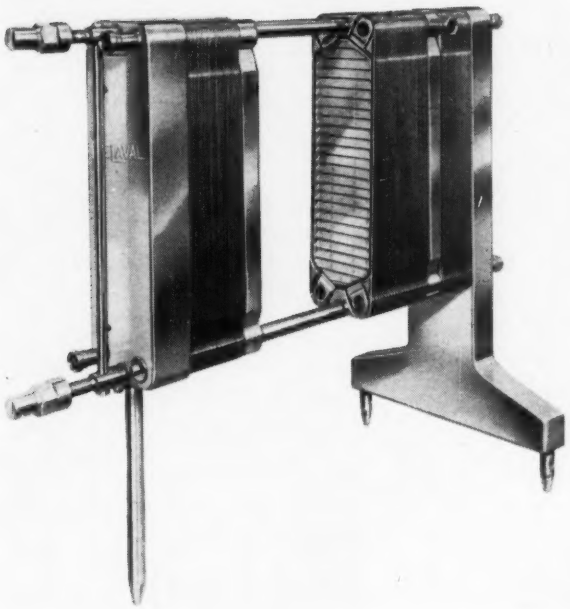

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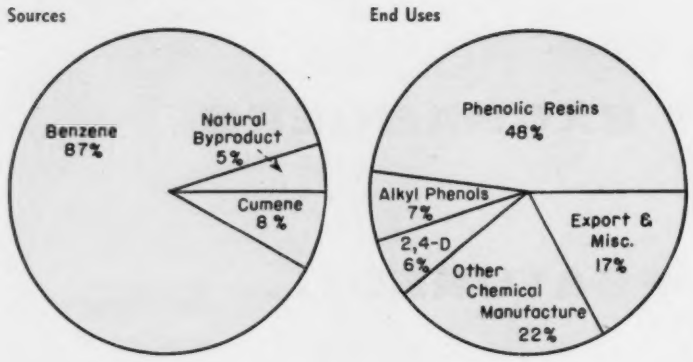
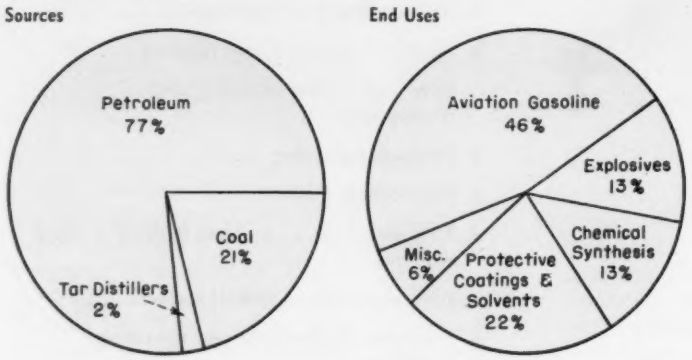
Phenol, 1954 (418 million lb. produced)



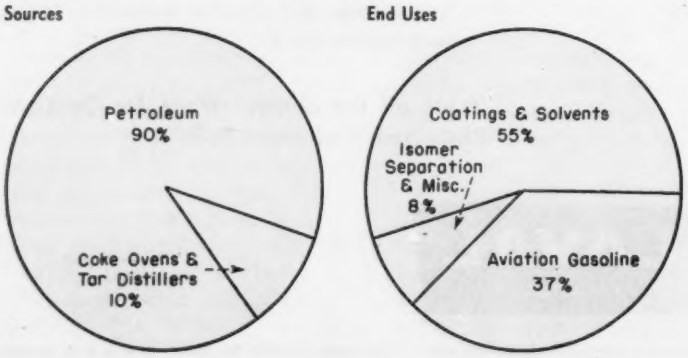
U. S. Phenol Capacities, 1955

Producer	Location	Process	Million Lb./Yr.
Allied Chemical—Barrett	Frankford, Pa.	Cumene	25
		Sulfonation	12
Dow Chemical	Midland, Mich.	Chlorobenzene	220
Durez Plastics	North Tonawanda, N. Y.	Raschig	65
Hercules Powder	Gibbstown, N. J.	Cumene	25
Monsanto Chemical	St. Louis, Mo.	Sulfonation	115
	Avon, Calif.	Sulfonation	
Oronite Chemical	Richmond, Calif.	Cumene	35
Reichhold Chemicals	Tuscaloosa, Ala.	Sulfonation	65
Union Carbide—Bakelite	Marietta, Ohio	Raschig	60
Others (all natural)			25
Total			647

Toluene, 1954 (159 million gal. produced)



Xylene, 1954 (110 million gal. produced)



tions on supply from coke-oven sources, the petroleum industry has undertaken construction of facilities to supply large quantities of these materials.

As we show on page 290, petroleum, through catalytic reforming, now accounts for about 36% of all benzene produced in this country. Principal makers of petroleum-benzene, in order of size, are Standard Oil of California, Shell Oil and Standard Oil of Indiana. The main outlets for benzene in order of importance are styrene, phenol, synthetic detergents, aniline and DDT. All these are expected to show continued growth.

▶ **There's Excess Phenol**—U. S. phenol production in 1954 was 418 million lb. About 50% of this went into phenolic resins. As indicated at left, phenol capacity by the end of this year is expected to be considerably greater than 1954's production level.

▶ **Toluene, Xylene**—Petroleum is now the principal source of toluene (*chart, left*). About 77%, or 123 million gal., of total U. S. toluene output was petroleum-derived in 1954. Markets for this commodity depend largely on military uses. Aviation gasoline takes about 46% of production, with dynamite and other explosives accounting for about 13%.

Xylene is the third of the important aromatics now coming from petroleum. About 90% of 1954's total production of 110 million gal. was petroleum-born.

More important than the production of mixed xylenes—used mainly as solvents and thinners for resins, paints and enamels—has been the development of pro-

Correction

In part I of this petrochemicals series (Sept., p. 270) we reported total synthetic ammonia capacity in place as of Jan. 1955 as 3,362,000 tons/yr., equivalent to 2,620,000 tons/yr. of contained nitrogen. The latter figure should have been 2,769,000 tons/yr. of contained nitrogen.

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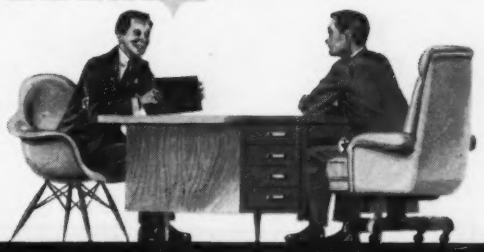

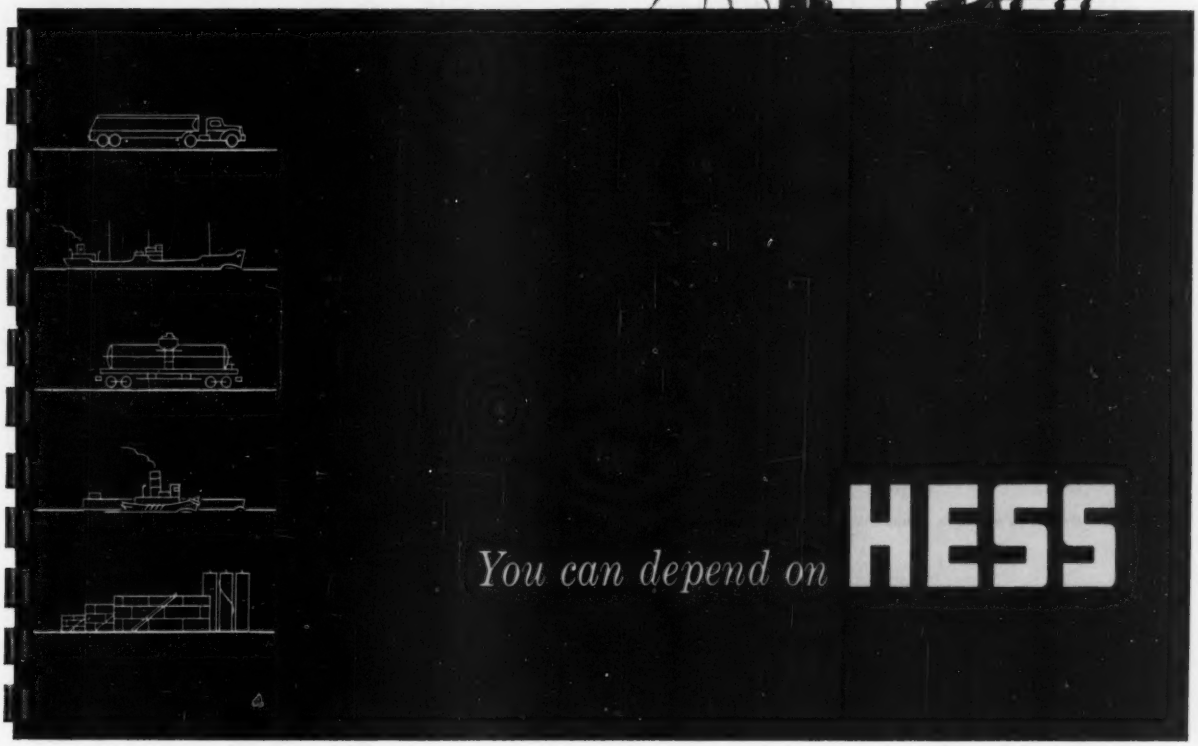

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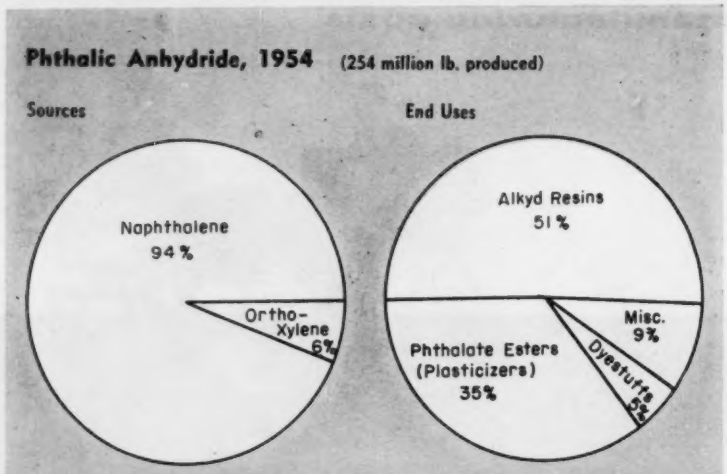


U. S. Phthalic Anhydride Capacities, 1955

Producer	Location	Million Lb./Yr.
Allied Chemical		145
Barrett	Philadelphia, Pa.	
	Ironton, Ohio	
	Chicago, Ill.	
National Aniline	Buffalo, N. Y.	
American Cyanamid	Bridgeville, Pa.	65
Koppers	Kobuta, Pa.	15
Monsanto Chemical	St. Louis, Mo.	55
	Everett, Mass.	
Pittsburgh Coke & Chemical	Neville Island, Pa.	12
Reichhold Chemicals	Detroit, Mich.	20
	Elizabeth, N. J.	
Sherwin-Williams	Kensington, Ill.	6
Standard Oil (Calif.)	Richmond, Calif.	60*
Total		378

* Includes 50 million lb. of isophthalic acid

cesses for the recovery of pure xylene isomers. Standard Oil of California was the first to make pure *p*-xylene and was followed by Humble Oil, Phillips Petroleum and more recently by Sinclair Refining. The para isomer serves as raw material for terephthalic acid used in Du Pont's Dacron.

Standard of California is also the principal producer of o-xylene from petroleum. They use ortho as the starting point in making phthalic anhydride.

▶**Isophthalic Challenges**—Most phthalic anhydride is now made from naphthalene. Above is a list of the important producers with their estimated capacities.

You'll note that the estimate include 50 million lb. of isophthalic acid from Standard of California. This is produced from the meta isomer of xylene and there will be considerable interest in its effect on the traditional markets for phthalic anhydride. Production is just starting and selling price has been set at 23¢/lb., compared with the current 20¢/lb. for phthalic anhydride.

▶**No Growth Limit Seen**—It's obvious that petrochemicals are prime building blocks in the manufacture of many products—industrial as well as consumer. As population grows, chemicals are bound to grow at least as fast, probably faster. And it seems certain that petrochemicals will continue to grab a bigger and bigger share of the total chemical market every year.

Big Economic Changes Predicted by 1975

A work week six hours shorter, yet 25% more pay! Total population of 213 million, total employment of 85 million! About 84 million passenger cars and 18 million trucks and buses on the road!

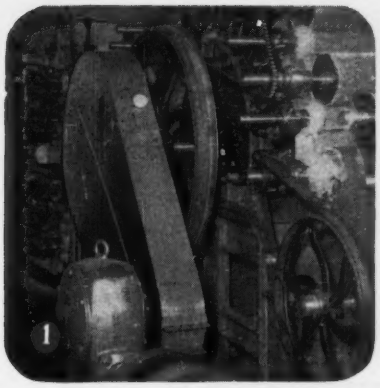
These and a lot more advances for the American economy by 1975 were forecast recently by 26 top business executives. Occasion was the cornerstone laying for a new office building to house four mutual investment firms at Elizabeth, N. J.

Most significant predictions for the chemical process industries were by these four company presidents:

• J. D. Zellerbach, Crown Zellerbach Corp.: "I expect that the continued growth of the U. S. economy over the next 20 years will amaze the world and, very probably, ourselves as well. In fact, I think most Americans will have to become accustomed to seeing new economic records set continuously without fearing that increasing prosperity necessarily leads to some sort of economic collapse. . . . The paper and paperboard industry will undergo many changes in the next 20 years; and if the growth of recent years is maintained we may expect the industry to produce about 50 million tons of paper and board in 1975 as compared with nearly 27 million tons in 1954."

• E. J. Thomas, Goodyear Tire & Rubber Co.: "In our estimation vehicle registration (by 1975) should reach 84 million passenger cars and 18 million trucks and busses. Total tire production by the rubber industry in the U. S. should amount to 125 million passenger car tires and 22 million truck and bus tires. Our estimate of the domestic consumption of new rubber, both synthetic and natural, by 1975 would be 2.3 million long tons/yr. For comparative purposes the 1955 consumption figure is at the rate of 1.5 million long tons which is up to now an all-time high."

• T. S. Petersen, Standard Oil Co. of California: "The petroleum industry will face heavy demands to meet the rapidly growing market. By 1975, the energy requirements of the U. S. may exceed the equivalent of over 36 million bbl. of crude oil per day, approximately twice present needs. Our domestic crude production may furnish a third or more of these requirements. The petroleum industry will have to



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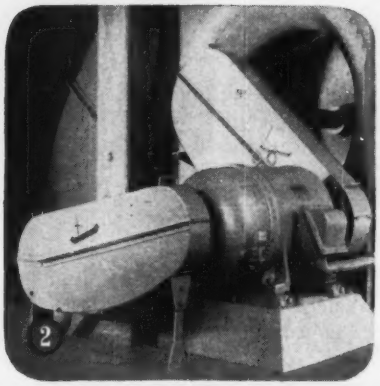

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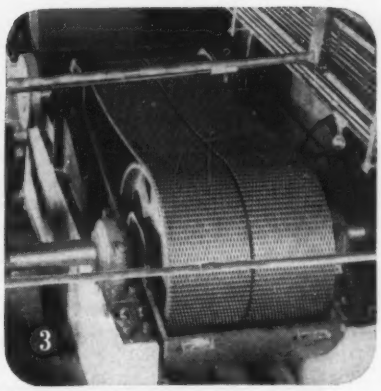

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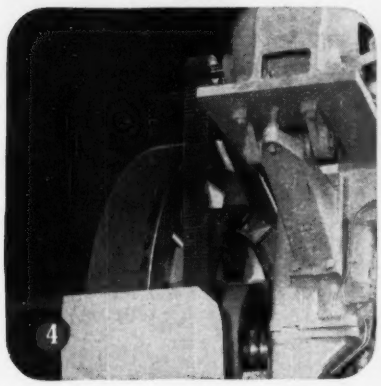

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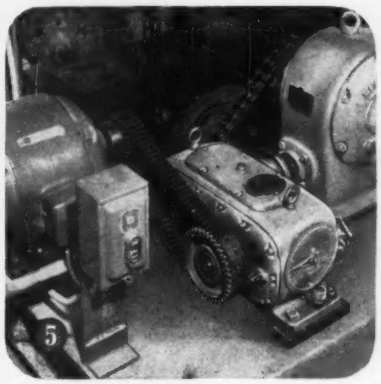

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ECONOMICS . . .

carry on a greatly expanded program of capital investment in exploration, producing, refining, transportation and marketing these products in order to contribute its share to the large and more prosperous economy which we see for 1975."

•M. J. Rathbone, Standard Oil Co. (N. J.): "Atomic energy should be meeting a share of our energy needs (by 1975) but the share seems likely to remain a minor one in our total energy picture. Coal use should have leveled off, probably at about 500-600 million tons. Hydroelectric power should have expanded very moderately. Natural gas should have continued to furnish an important part of our energy supply but its rate of growth should have been very modest compared to its growth in the years before 1955. (The 1975) energy workhorse promises still to be petroleum. The U. S. should require about 60% more than now —in excess of 13 million bpd. as compared to more than 8 million bpd. today."

GUIDED TOUR CONTINUED

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TWENTY-FOOT LENGTHS of 10" I.D. copper tubes receive final inspection in one of the mills of The American Brass Company. ANACONDA Seamless Drawn Copper Tubes are made up to 26" I.D.

Anaconda Copper Tubes install easier ... last longer

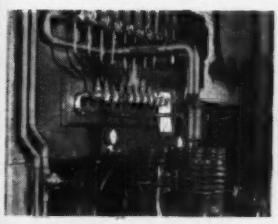
Planning a new installation? Want to replace unsatisfactory piping? Then look into the performance advantages of ANACONDA Copper Tubes *first*. Many plants have found them the best all-around piping material available.

Here's why: ANACONDA Copper Tubes are light. They come in long lengths. Smaller sizes are bent right on the job. All this means big savings on installation costs. And copper tubes can't rust. They resist corrosion and guard against contamination. Smooth interiors mean smoother flow. Pumping costs are often lower.

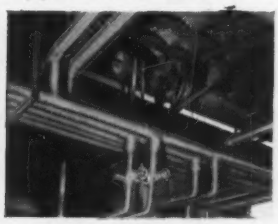
Here's another advantage. ANACONDA Copper Tubes – connected with solder-type fittings – can be taken down, moved or have new connections cut in faster than with threaded pipe. *You can meet changing plant conditions easily.*

If we can be of assistance in solving a piping problem in your plant please write to: *The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Limited, New Toronto, Ont.* 5446A

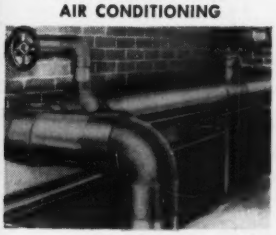
Use Anaconda Copper Tubes for:



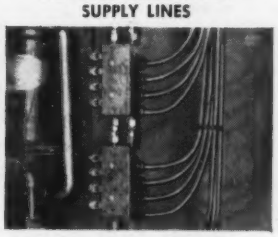
REFRIGERATION AND AIR CONDITIONING



HOT AND COLD WATER SUPPLY LINES



INDUSTRIAL HEATING LINES



AIR, LUBRICATING AND HYDRAULIC LINES

for copper piping call an

ANACONDA®

Distributor

"VISKON® Filter Fabric Upped My Production 25% and Saved Me from Buying An Extra Filter Press!"

"I can clean 40 plates of VISKON filter fabric in 10 minutes of downtime. This permits me to maintain continuous line production and high standards of quality since time is important in pasteurizing honey. My previous downtime had been one hour after each filter cycle about every four hours. Beside this, diatomaceous earth will not go through VISKON—therefore, my filtrate is much clearer... When it comes to filtering food under certain conditions, I just can't see how anyone could do a better job than with VISKON filter fabric."

—Raymond Fischer
Fischer Apiaries
North Little Rock, Arkansas

IF YOU HAVE PLATE and FRAME FILTERS, CHECK VISKON for LOWER COSTS, GREATER EFFICIENCY

Here's Why . . . . . .

VISKON filter fabric is particularly well suited for plate and frame filtering. It steps up efficiency to such a degree that old equipment becomes highly productive.

VISKON filter fabric lasts longer because of the special bond which protects each nonwoven fiber, yet permits a high degree of flow rate. VISKON has amazing wet strength.

VISKON filter fabric cleans quickly, easily. Frequently the filter cake falls off when plates are released to be cleaned. A low pressure hosing with water usually gets the job done.

VISKON filter fabrics are available in cotton and synthetic fibers and in various blends in many weights and finishes. VISKON withstands normal filtering temperatures.

VISKON filter fabrics are insoluble in common organic solvents and can be backwashed on line operations.

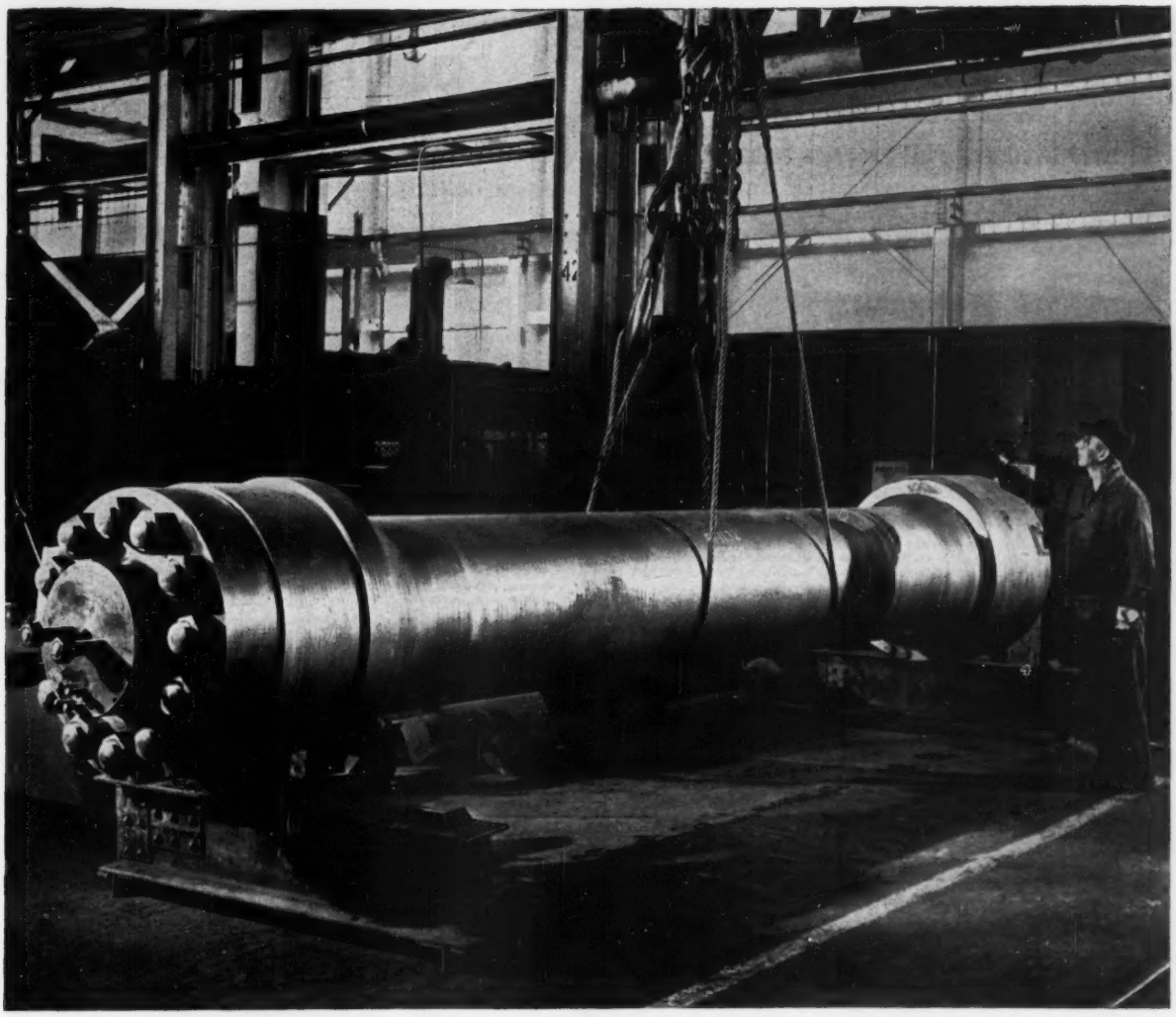
VISKON filter fabric saves you money! You save on downtime. You save on material cost even when you throw away VISKON filters. Yes, here is a new filter medium to save you money on materials and labor—yet gives you better operating efficiency!

Use This Handy Coupon Or
Dictate Your Inquiry Letter To:

Mr. A. I. Pierce, Filter Media Engineer
THE VISKING CORPORATION
P. O. Box 72 . . North Little Rock, Arkansas. .

NAME_____
ADDRESS_____
CITY_____ ZONE____ STATE_____
Type of Filter Press_____

VISKON®
nonwoven fabrics



Another Converter Ready

This is another of the many recent pressure vessels forged and machined in the Bethlehem shops. A 14-ton converter, it has an overall length, fully assembled, of 20 ft 5 in. The ID of the shell is 18 in.; the OD, 26 in. Shell and heads are of forged alloy steel. Save for a few finishing touches, it is ready for delivery to the buyer, whose exacting specifications were met in full.

The vessel falls in the small-to-medium range, and is not comparable in weight to some of the giants we build. But it required extremely detailed machining, and that is a point we'd like to bring out. No matter how intricate the job, Bethlehem's expert machinists and equipment are equal to it. Bethlehem-built vessels are *finish*-machined, and the work is of A-1 caliber, always.

Are you planning new converters? Or filters, reactors, separators, autoclaves, or accumulators? If so, our engineers will be very glad to discuss things with you. They'll talk your language, and will render every possible service. Please feel free to call them, of course without obligation.

BETHLEHEM FORGED VESSELS
are built in every size . . . every type
for the
chemical, rubber, petroleum, fertilizer,
food-processing, and allied industries.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

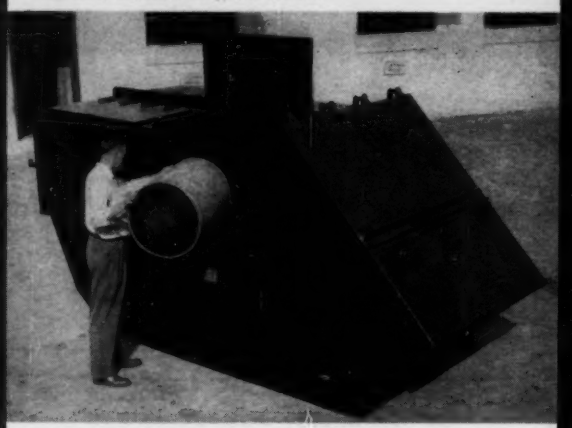
BETHLEHEM STEEL

COLLECT IT

AS IT ACCUMULATES — SOLIDS, POWDERS, SLUDGE, LIQUIDS
RAW MATERIALS, FINISHED PRODUCTS, WASTE MATERIALS

Heavy waste is dumped into an open container at a foundry in New York. The first step in the LOAD LUGGER SYSTEM of materials handling is to place a number of containers at strategic points to collect material as it accumulates, reducing handling at the point of origin.

Light material accumulates in an open container with high sides at a shipping carton plant in Louisiana. Rugged LOAD LUGGER containers are built of welded steel, have deep leak-proof bottoms, hold from 1½ to 14 cubic yards and more, and handle all types of material.



It is easy to load this 14-cubic-yard LOAD LUGGER container of a St. Louis contract hauler. It fills to the top without raking and is wind-proof and rat-proof. A model with rubber seals and latches is also theft-proof, fly-proof, dust-proof, and almost odor-proof.

PICK IT UP

ALREADY LOADED — NO LOST TIME AND NO LOADING CREWS
LET ONE TRUCK AND DRIVER DO IT ALL — REPLACING MANY

A full container is picked up at a refinery in Indiana. The second step in the LOAD LUGGER SYSTEM is for one driver and his truck equipped with a hoist-body to pick up full containers on a regular schedule. This procedure does away with lost time and loading crews and eliminates the need for several conventional trucks and their drivers.

A bearing manufacturer in Ohio picks up a full container of dolomite. LOAD LUGGER hoist-bodies (flat-bed truck bodies with a pair of hydraulic-powered hoisting arms) handle pay loads of up to 18,000 pounds and more. They are easily mounted on any truck chassis of suitable capacity, and all controls are installed in the cab.

An open container used for accumulating industrial wastes is picked up by a Chicago contract hauler. For greater safety, LOAD LUGGER hoist-bodies lift containers with four-point suspension and have double-acting hydraulic cylinders for positive control at all times.

LOAD LUGGER®

- FLAT-BED TRUCK BODIES WITH HYDRAULIC HOISTING ARMS
- LEAK-PROOF TILT-DUMP CONTAINERS FOR BULK MATERIALS

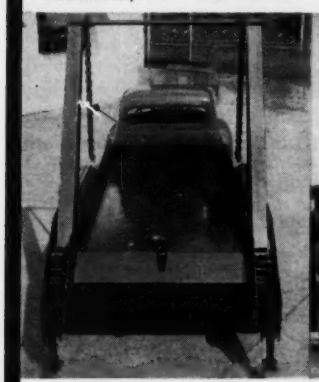
ENGINEERING B-W PRODUCTION

HAUL IT

IN MANY TYPES OF CONTAINERS — OR ON THE TRUCK BED IN PLANT AND OVER THE ROAD — ON YOUR TRUCK CHASSIS

A city truck in Ohio hauls a full container of repair materials. Government approval is evidenced by the many such municipal, state, and federal installations. Hauling full containers is the third step in the LOAD LUGGER SYSTEM, and over-the-road hauls are as feasible as in-plant because of the use of standard truck chassis.

A full container of residue materials is hauled at a corn products processing plant in Illinois. LOAD LUGGER hoist-bodies carry containers well forward for correct load distribution and cradle them between steel sidewalls for greater travel safety.



LOAD LUGGER hoist-bodies also carry materials or equipment directly on their flat beds, loading and unloading heavy objects with their hoisting arms.

This special hoist-body of a Michigan telephone company transports heavy cable reels. Such new uses for LOAD LUGGER equipment are constantly being developed.

DUMP IT

BY TILTING CONTAINER VERTICALLY OVER REAR APRON, OR DELIVER IT BY EXCHANGING FULL CONTAINER FOR AN EMPTY

Spent solvents are dumped into incinerator tank at a drugs and medicines manufacturing plant in Michigan. Delivering full containers or dumping their loads is the fourth step in the LOAD LUGGER SYSTEM. Returning empty containers then completes the cycle.

Metal scrap is dumped and spread in the yards of a scrap metals service company in Iowa. LOAD LUGGER hoist-bodies handle more pay load on a given truck chassis, because they are lighter than comparable equipment. And their patented simplicity, clean design, and sturdy construction make them cost less to buy and maintain.

Equipment of a Miami contract hauler in the dumping position. The LOAD LUGGER hoist-body has outrigger jacks to protect rear springs and axles from injury while picking up and putting down heavily loaded containers, but it neither needs nor uses these jacks while tilting container over rear apron to dump or spread the load.

ENGINEERED, MANUFACTURED, AND MARKETED BY

Ingersoll

KALAMAZOO DIVISION

SUCCESSOR TO BROOKS EQUIPMENT & MFG. CO.

BORG-WARNER CORPORATION

EXPORT SALES: BORG-WARNER INTERNATIONAL CORP., CHICAGO

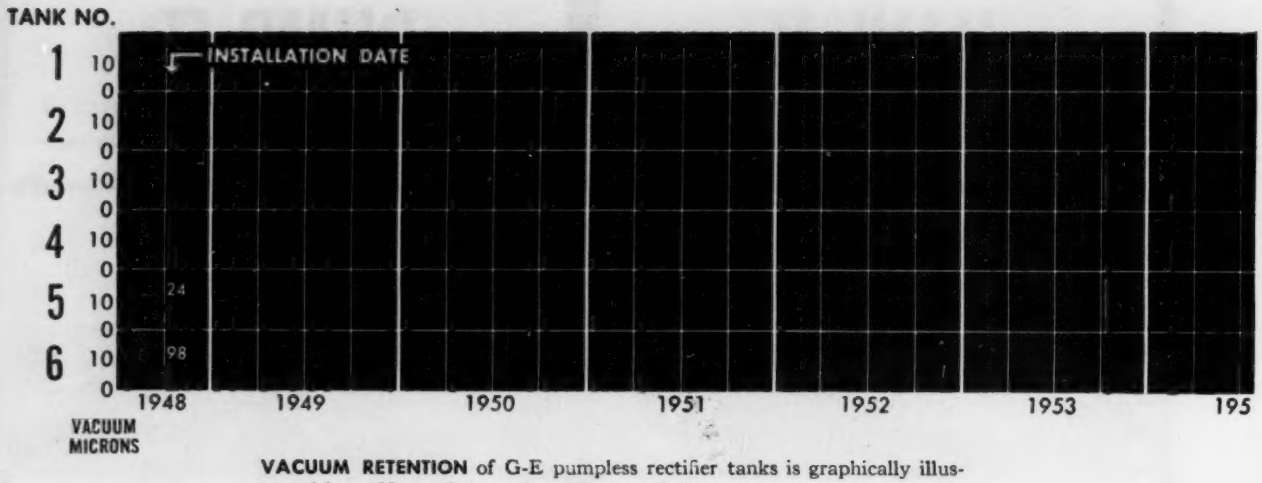
For more information mail this coupon to: INGERSOLL KALAMAZOO, DIVISION
1828 N. Pitcher St., Kalamazoo, Mich.

Name and position

Name of company

Street address

City, zone, state



VACUUM RETENTION of G-E pumpless rectifier tanks is graphically illustrated here. None of these six tanks, installed almost seven years ago at the Buffalo plant of the Wickwire Spencer Steel Division of the Colorado Fuel and Iron Corporation, has ever required maintenance. This endurance test is conclusive proof that the G-E pumpless tank is an outstanding performer.

Not one cent has ever been spent for repairs on a G-E pumpless rectifier tank

Since 1948—when the first General Electric pumpless rectifier unit was installed—not a single customer anywhere in the country has paid out a penny for vacuum tank repair. And this is only a start. G-E engineers estimate a much longer life for this equipment. Here's why:

"PERMANENTLY-SEALED" TANKS, manufactured under almost antiseptic conditions, eliminate the need for a pumping system. This, in turn, eliminates such problems as mercury migration between tanks and the possibility of shutdown due to vacuum-system failure.

SUPERIOR MANUFACTURING AND TESTING methods have made this exclusive sealed-tank design possible. Tanks are assembled in a special air-conditioned room, then baked, pumped-down and sealed to assure the best possible vacuum. To check the possibility of even the most minute leak, tanks are pumped in a helium atmosphere and the exhaust is examined by a mass spectrometer leak detector capable of detecting one part of helium in 100,000 parts of normal air.

FACTORY RECONDITIONING of tanks, should it be necessary, is a relatively inexpensive process and relieves you of tank maintenance problems. The tank is reconditioned under the same controlled factory conditions described above and returned ready for more years of service. You can operate with a spare tank during reconditioning.

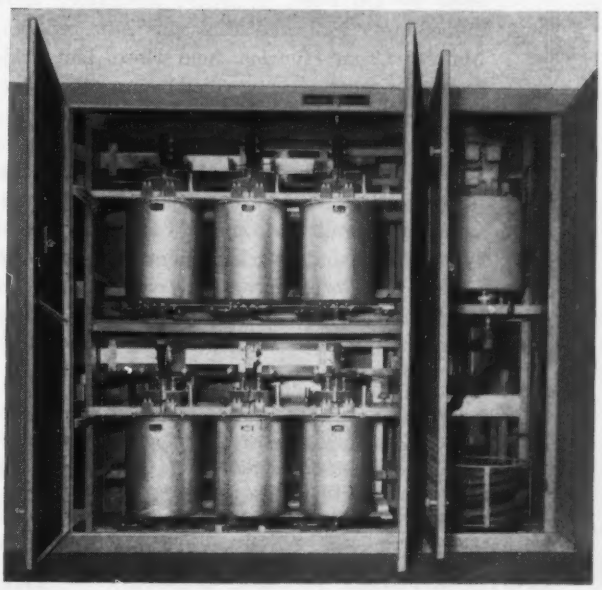
ADD TO THIS the highly efficient operation of mercury-arc conversion and you'll find that G-E pumpless rectifiers are the most economical way to get d-c power in the 750-kw range and above. For the whole story, contact your nearest G-E Apparatus Sales Representative or write for bulletin GEA-5689. General Electric Company, Schenectady 5, New York. 524-2

Progress Is Our Most Important Product

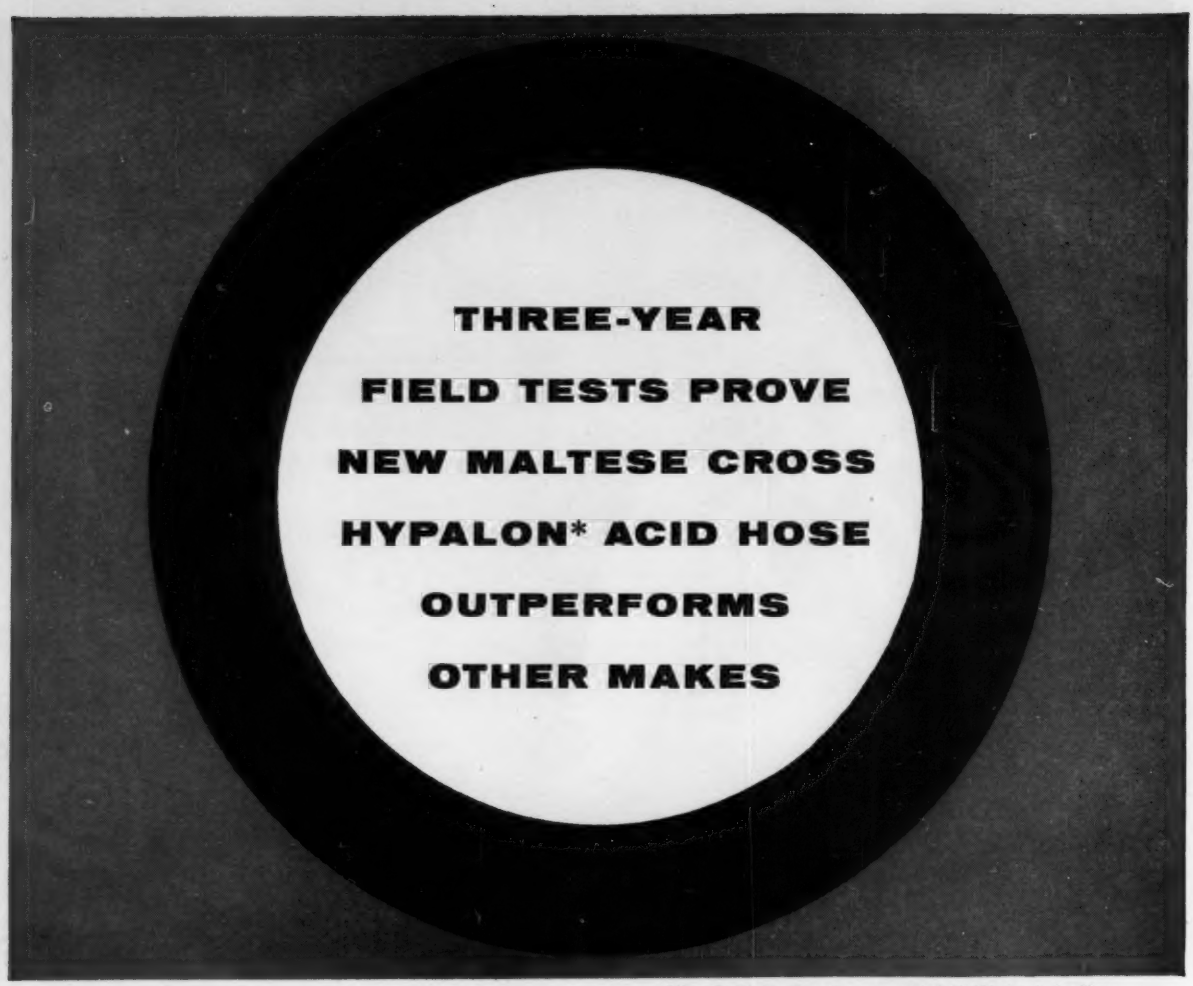
GENERAL ELECTRIC

ASSEMBLY ROOM for pumpless-rectifier tanks is clean, air-conditioned to help prevent contamination. After assembly, testing with mass spectrometer leak detector assures that tanks are free from even the most minute leaks.

LONG LIFE AND LOW MAINTENANCE are the payoff when these tanks are put into service. The six-tank rectifier compartment shown here is furnished with transformer and associated a-c and d-c switchgear—a completely metal-enclosed d-c substation which requires a minimum of floor space.



GENERAL ELECTRIC



*Reg. T. M. Du Pont Company HYPALON chemical rubber.

Three years ago chemists at the Hewitt-Robins Research Laboratories in Buffalo produced an experimental acid hose having a tube compounded with *Hypalon*, a remarkable new polymer developed by Du Pont. Intensive laboratory tests immediately indicated that this new product, Maltese Cross *Hypalon* Acid Hose, had acid-resistant properties unequalled by any other hose. The question was, would it perform equally as well in actual industrial applications as it had in the lab? To find the answer, many lengths of this new hose were put to work at industrial installations throughout the country, handling different types of acids under various operating conditions.

Now, after three years, the reports are in . . . the results show Hewitt-Robins' new Maltese Cross Hypalon Acid Hose has conclusively proven superior in case after case!

Here is a typical field report: "In September, 1952, a 50' length of 2" hose was installed for testing at the Hilfinger Corporation, Toledo, O. Since that time it has been used every other 8-hour shift to handle chromic acid (40% solution by weight) at 105° F. Whereas all previous hoses had failed in 6 to 8 months due to the effect of the acid on the tube, Maltese Cross *Hypalon* Acid Hose is still in service and as yet shows no sign of deterioration."

Get all the facts about how Hewitt-Robins' new Maltese Cross *Hypalon* Acid Hose can improve your acid handling hose service. For immediate information, contact your local Hewitt-Robins Industrial Supply Distributor (see classified phone book) or write directly to our executive offices in Stamford, Connecticut.

Conveyor Belting & Machinery
Vibrating Equipment—Industrial Hose
Conveyor Design & Engineering
Molded Rubber Products

Hewitt-Robins

See us at Booth C-14 December 5th through 9th in Philadelphia. We are featuring our new hi-speed Vibrex.

HEWITT-ROBINS INCORPORATED · EXECUTIVE OFFICES: STAMFORD, CONNECTICUT

What to Look For at the Chem Show

The "Silver Anniversary" Exposition wraps up in one easy-to-take package the full range of current process industry activities. You'll leave Philadelphia with new ideas, contacts and help with your problems.

Ingredients that can give you the quickest yet most thorough recap of the past two year's progress in the chemical industry will be assembled at Philadelphia's Convention Hall for the 25th Exposition of Chemical Industries next December 5 to 9.

More than 500 exhibits cover the length and breadth of the industry: from new designs for such industry workhorses as pumps and thermocouples to nuclear frontiers; from new chemicals and raw materials on through the whole range of equipment categories. The show brings together, of course, not only exhibits but also people who can give expert testimony to the latest achievements in each field. Out of this rare combination of a wide selection of "visual aids" plus personal contacts are bound to come ideas that will provide you with solutions to some of your own professional problems.

► **New Processing Equipment**—The Chem Show boasts a number of firsts in every category. One of these will be an adaptation of a successful type of continuous processing heat transfer apparatus to the manufacture of open-cell flexible vinyl foam.

Another first, to be found in an exhibit of crushers for wax-like and semi-sticky or caked-up materials, is a wax chipper which reduces standard slabs of waxes, paraffins and other rosin-like substances to chips, ⅛- to ⅜-in. in thickness, to speed melting and solubility. The exposition will also provide examples of how the methods of size reduction commonly applied to ores, coal and other minerals may be profitably used for a number of specialized chemical applications.

One of the exhibitors who design, build and equip complete chemical plants will display a scale model of three ammonium nitrate plants of its own design that are already in use.

Also on view will be a full-blown display of units employed in manufacturing pharmaceutical products.

► **Fluids Handling Equipment**—A strikingly different type of colloid mill, having a newly designed rotor with an easily replaceable stator and a new shaft seal, will be on exhibit. There will also be a hydraulic pressure-exchange pump of completely new design for handling abrasive products. Its capacity is 125 gpm. at pressures up to 2,000 psi.

To transfer high viscosity liquids at relatively high speeds and efficiencies, there will be a double screw pump. The sample to be shown will move a 200,000 SSU viscosity oil at pressures up to 300 psi. and suction lifts to 20 in. of mercury. To handle extremely large capacities at low heads, there will be plastic pumps of two advanced designs.

► **Chemical Products and Raw Materials**—From recently-built manufacturing facilities, new chemicals such as a new grade of furfurol alcohol and sodium bisulfate in pelletized globular form will be exhibited.

The new furfurol alcohol grade is substantially free of buffers, lighter in color and of more uniform quality than the one previously offered from the same source. Over fifty end uses of furan chemicals, ranging from weed killers to nylon hosiery, will be shown for the first time in the East. All

these substances have their origin in agricultural residues.

The pelletized globular form of sodium bisulfate is used as an acid-type cleaner. The display of this new product will include a "Dry-Eye" system for refrigeration plants—a drier, containing a form of activated alumina, built on a T-flow principle and including a moisture indicator which shows whether the refrigerating system is wet or dry.

▶**Materials of Construction**—The show is helping to introduce porcelain enameled steel to the chemical industry as a positive means of protection from acid fumes on roofing and siding. It has long given successful service in the housing of steel mills.

Stainless steel in sheets and plates will form the basis of an exhibit which will have a stainless steel elevator interior as a center piece. Ni-O-Nel, samples of which will be shown at another booth, has been developed to deal with corrosive conditions of unusual severity such as those involved in handling hot sulfuric acid solutions.

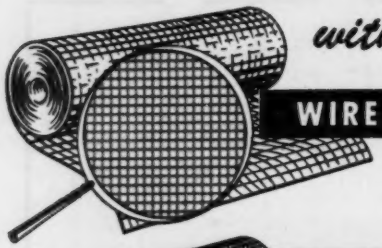
One of the few producers of commercially pure and alloy titanium will feature samples of that metal in its various forms at the exposition. The metal is of growing importance in chemical engineering because of its exceptional strength-to-weight ratio and high corrosion resistance.

There will be expansion joints and flexible hose manufactured from a stainless steel alloy and parts made by a radically new casting process in which ceramic molds are utilized. The latter method assures designers such special advantages as smooth surfaces, intricate shapes, thin sections, close tolerances, reduced machining costs. Also on view will be shell molded castings for aircraft, chemical equipment, and power generation.

▶ **Instruments and Controls**—A newly-introduced thermistor-actuated remote indicating controller will have its first Chemical Exposition showing. It combines three operating modes: "on-off," proportional control and adjustable differential. And, representing an efficient combination of the advantages of both electric and pneumatic control for industrial processes,

Let MULTI-METAL Help Solve Your Filtering and Screening Problems

with METALLIC SEPTA



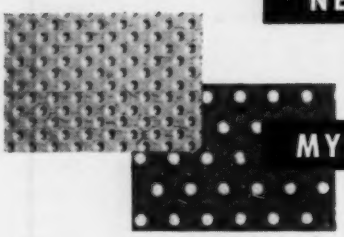
WIRE CLOTH

Plain, twilled, herringbone and cabled weaves in all meshes.

FILTER CLOTH

Plain or twilled Dutch, or braided, in every degree of density.

The above available in all commercial metals in all widths.



NEVA-CLOG

Rigid, perforated, double sheet, non-plugging—for filter leaves, tower bottoms, etc.

MYKRO-PORE

Electro-deposited, metallic, conical hole sheet openings as fine as 30 microns.

Research and Engineering

Multi-Metal investigations on flow rates, filter media structures and coordinate technical aspects of filtration and screening have led to better processing equipment.

Fabrication of Components or Complete Equipment

See Us at the Chemical Show

Be sure to see the exhibit of Multi-Metal "Know-how" in Booth 204, Exposition of Chemical Industries, Philadelphia, December 5 thru 9, 1955. See the demonstration of actual filtration, using various filter media in Multi-Metal's Visual Filter.

WRITE FOR CATALOG 50

MULTI-METAL WIRE CLOTH CO., INC.
1353 GARRISON AVENUE • NEW YORK 59, N. Y.

Special Buses to Exposition

As a convenience for those attending the 25th Exposition of Chemical Industries, special bus service will be provided to the Exposition. Buses will leave principal hotels at frequent intervals for Commercial Museum and Convention Hall. Round-trip fare, 50¢; one way, 35¢. Look for sign in hotel lobby directing to boarding point.

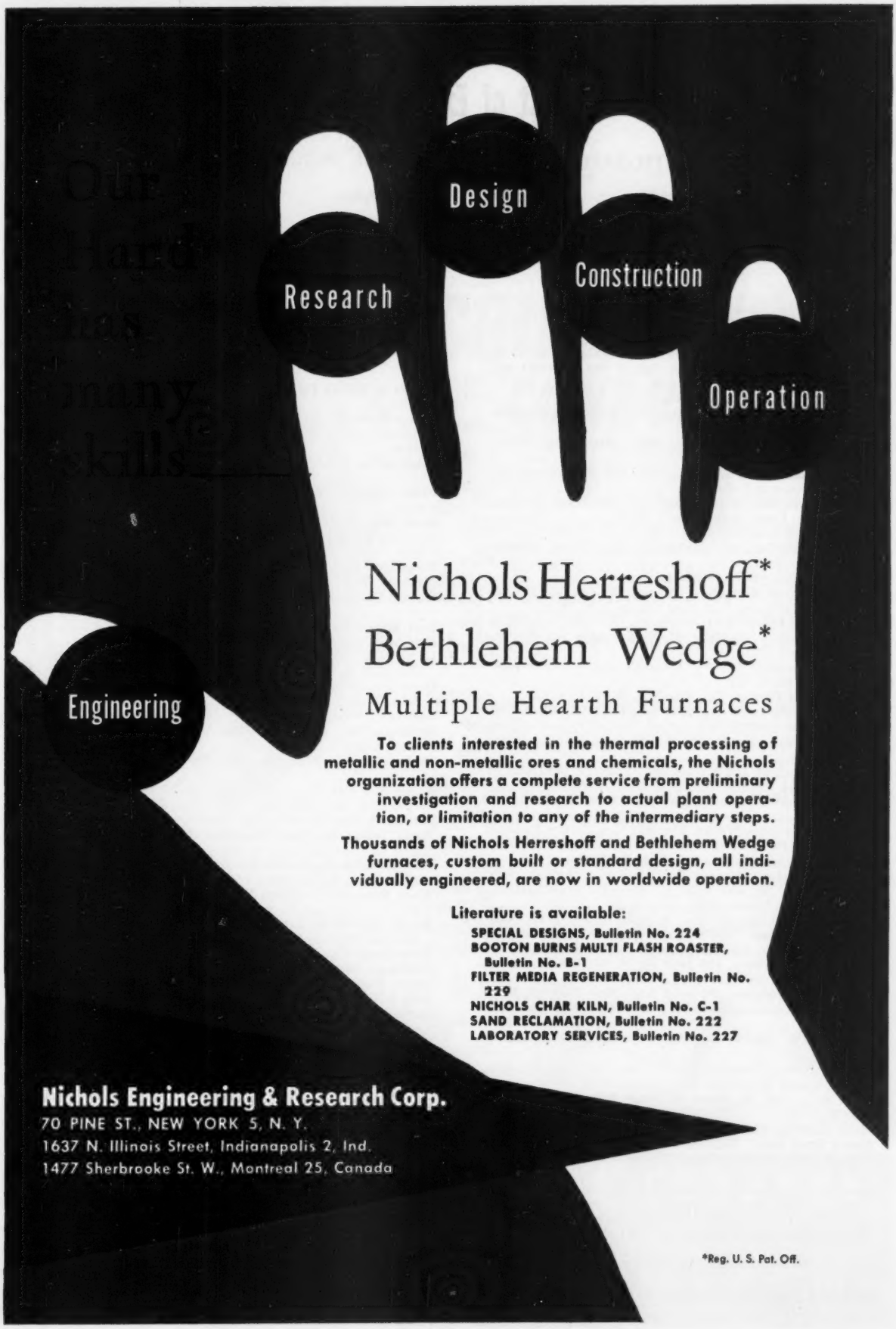
there will be an electro-pneumatic converter system.

Another innovation will be a series of miniature flow-control devices, principally automatic diaphragm-operated miniature flow valves.

One of the exhibits will consist of a complete line of aircraft, miniature, and industrial thermocouples as well as a line of electronic temperature measuring and controlling instruments. The line features a new "Ceramo" wire consisting of thermocouple conductors surrounded by magnesium-oxide insulation with an overall cover of seamless metal tubing. These wires can be bent on a radius as small as their own diameter, according to the manufacturer. They have excellent resistance to hammer blows, pressures up to 40,000 psi., temperature, moisture, chemicals, petroleum products and even atomic radiation.

▶ **Nuclear Developments**—The impact of nuclear science and engineering on the fields of chemistry will be reflected in a number of exhibits. As part of a complete line of chemical proportioning pumps, several types suited to atomic power plants will be exhibited. Another manufacturer will display radioisotopic hoods and offer information relative to equipment manufactured for the Atomic Energy Commission.

One of the most advanced exhibits will be a nuclear reactor simulator and control. It will show, for the first time, a relatively inexpensive device for use by researchers and instructors to synthesize electronically the conditions of actual nuclear reactor operation. The simulator and control also provide a visual introduction to "package" control systems for all types of nuclear reactors. The first such package control has already been installed on one research reactor.



Nichols Herreshoff* Bethlehem Wedge*

Multiple Hearth Furnaces

To clients interested in the thermal processing of metallic and non-metallic ores and chemicals, the Nichols organization offers a complete service from preliminary investigation and research to actual plant operation, or limitation to any of the intermediary steps.

Thousands of Nichols Herreshoff and Bethlehem Wedge furnaces, custom built or standard design, all individually engineered, are now in worldwide operation.

Literature is available:

SPECIAL DESIGNS, Bulletin No. 224
BOOTON BURNS MULTI FLASH ROASTER, Bulletin No. B-1
FILTER MEDIA REGENERATION, Bulletin No. 229
NICHOLS CHAR KILN, Bulletin No. C-1
SAND RECLAMATION, Bulletin No. 222
LABORATORY SERVICES, Bulletin No. 227

Nichols Engineering & Research Corp.
70 PINE ST., NEW YORK 5, N. Y.
1637 N. Illinois Street, Indianapolis 2, Ind.
1477 Sherbrooke St. W., Montreal 25, Canada

*Reg. U. S. Pat. Off.

List of Exhibitors

25TH EXPOSITION OF CHEMICAL INDUSTRIES

Convention Hall—Philadelphia

December 5-9, 1955

Name of Exhibitor	*Booth No.*
Ace Glass Inc, Vineland., N. J.	710
Ackerman, Harold P., 320 McClatchy Bldg., Upper Darby, Pa.	824
Adams Co., R. P., 225 East Park Dr., Buffalo 17, N. Y.	410
Aetna Scientific Co., Second & Spring Sts., Everett 49, Mass.	221
Airetool Mfg. Co., The, Springfield, Ohio	S-74
Alberene Stone Corp. of Virginia, 419 Fourth Ave., New York 16, N. Y.	533
Allegheny Ludlum Steel Corp., 2020 Oliver Bldg., Pittsburgh 22, Pa.	28
Allen-Sherman-Hoff Pump Co., The, 259 East Lancaster Ave., Wynnewood, Pa.	C-119-C-121
Allis-Chalmers Mfg. Co., P.O. Box 512, Milwaukee 1, Wis.	934
Allis Co., The Louis, Milwaukee 7, Wis.	931
Alloy Steel Products Co., Linden, N. J.	35
Alpha Plastics Inc., 14 Northfield Ave., West Orange, N. J.	S-108
Alsop Engineering Corp.. Milldale, Conn.	110
Aluminum Co. of America, Pittsburgh 19, Pa.	233-235
American Agile Corp., P. O. Box 168, Bedford, Ohio	817
American Air Filter Co., Louisville 8, Ky.	150 & 250
American Chemical Society, 1155 Sixteenth St. N. W., Washington 6, D. C.	1
American Chemical Society News Service, 2 Park Ave., New York 16, N. Y.	1
American Gas Furnace Co., Elizabeth B, N. J.	638
American Institute of Chemical Engineers, 25 West 45th St., New York 36, N. Y.	828
American Instrument Co., 8030-8050 Georgia Ave., Silver Spring, Md.	736
American Machine and Metals, Inc., Tolhurst Centrifugals and Niagara Filters Divisions, East Moline, Ill.	802-806
American Plant Equipment Co., 701 Spring St., Elizabeth 4, N. J.	S-65
American Platinum Works, The, 231 New Jersey Railroad Ave., Newark 5, N. J.	C-17, C-19, C-21
American Tool & Machine Co., Hyde Park, Mass.	826
American Water Softener Co., Fourth & Lehigh Ave., Philadelphia 33, Pa.	S-64
American Well Works, The, Aurora, Ill.	C-160
Amersil Co., 685 Ramsey Ave., Hillside, N. J.	C-17, C-19, C-21
Ampco Metal, Inc., 1745 S. Thirty-Eighth St., Milwaukee 46, Wis.	913
Analytical Chemistry, 115 16th St. N. W., Washington 6, D. C.	1
Analytical Chemistry, 430 Park Ave., New York 22, N. Y.	71
Analytical Measurements, Inc., 585 Main St., Chatham, N. J.	443
Anderson Co., The V. D., 1935 W. 96th St., Cleveland 2, Ohio	C-129
Andrews-Knapp Construction Co., Inc., 23-15 Borden Ave., Long Island City 1, N. Y.	19
Angel & Co., Inc., H. Reeve, 52 Duane Street, New York 7, N. Y.	725
Ansul Chemical Co., Marinette, Wis.	521
Armco Steel Corp., Middletown, Ohio	231
Artisan Metal Products Inc., 73 Pond Street, Waltham 54, Mass.	318
Associated Cooperage Industries of America, Inc., The 408 Olive St., St. Louis 2, Mo.	818
Atlas Mineral Products Co., The, Mertztown, Pa.	415, 417
Atlas Powder Co., Chemicals Div., Wilmington 99, Del.	302-304, 401
Aurora Pump Co., Subsidiary of The New York Air Brake Co., Aurora, Ill.	333-335
Autoclave Engineers Sales Corp., Building #1, Newark Airport, Newark 5, N. J.	434
Automatic Switch Co., 391 Lakeside Ave., Orange, N. J.	646
B-I-F Industries, Inc., 345 Harris Ave., Providence 1, R. I.	902

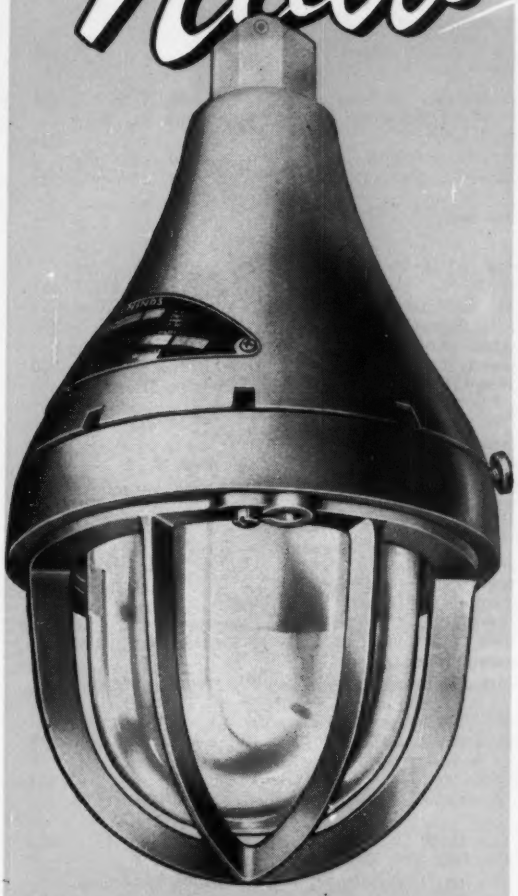
B

Babcox & Wilcox Co., The, Tubular Products Div., Beaver Falls, Pa.	75
Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland 10, Ohio	30
Baird Associates, Inc., 33 University Rd., Cambridge 38, Mass.	63
Baker & Co., Inc., 113 Astor St., Newark 5, N. J.	C-17 C-19, C-21
Baker Perkins Inc., Chemical Machinery Div., Saginaw, Mich.	540-544
Barco Mfg. Co., 500 N. Hough St., Barrington, Ill.	C-20
Barnebey-Cheney Co., Cassaday at Eighth, Columbus 19, Ohio	17
Barnstead Still & Sterilizer Co., 2 Lanesville Terrace, Forest Hills, Boston 31, Mass.	636
Barrett-Cravens Co., 630 Dundee Rd., Northbrook, Ill.	634 & 733
Bart Mfg. Corp., Belleville 9, N. J.	S-107
Bart-Messing Corp., Belleville 9, N. J.	S-107
Bartlett & Snow Co., The C. O., 6200 Harvard Ave., Cleveland 5, Ohio	247
Bean Div., John, Food Machinery and Chemical Corp., Box 840, Lansing 4, Mich.	326
Beaumont Birch Co., 1505 Race St., Philadelphia 2, Pa.	445
Beckman, Inc., Arnold O., 1020 Mission St., South Pasadena, Calif.	643
Beckman Div. Beckman Instruments, Inc., Fullerton, Calif.	20
Bemis Bro. Bag Co., 408 Pine St., St. Louis 2, Mo.	13
Berger Mfg. Div., Republic Steel Corp., Canton, Ohio.	535-539
Bethlehem Apparatus Co., 890 Front St., Hellertown, Pa.	C-148
Biach Industries, Inc., 10 Indian Spring Rd., Cranford, N. J.	C-131
Bird Machine Co., South Walpole, Mass.	321, 325
Bishop & Co., J., Platinum Works, Malvern, Pa.	809
Black Products Co., 135th St. & Calumet Ave., Chicago 27, Ill.	C-113
Black, Sivalls & Bryson, Inc., 7500 East Twelfth St., Kansas City 26, Mo.	114
Blaw-Knox Co., Farmers Bank Bldg., Pittsburg 22, Pa.	103
Blickman, Inc., S., Weehawken, N. J.	407
Bogue Electric Mfg. Co., 52 Iowa Avenue, Paterson, N. J.	421
Bolt & Nut Div., Republic Steel Corp., Cleveland, Ohio.	535-539
Bowen Engineering, Inc., North Branch, N. J.	613
Brabender Corp., Rochelle Park, N. J.	C-35
Brinkmann & Co., C. A., 378-380 Great Neck Rd., Great Neck, N. Y.	C-36
Brookfield Engineering Laboratories, Inc., Stoughton, Mass.	424
Brooks Rotameter Co., Lansdale, Pa.	606
Brown Fintube Co., Elyria, Ohio	948
Buda Co, The Div. of Allis-Chalmers Co., 154th & Commercial Ave., Harvey, Ill.	934
Buffalo Meter Co., 2917 Main St., Buffalo 14, N. Y.	442
Buflovak Equipment Div. of Blaw-Knox Co., Buffalo 11, N. Y.	103
Builders-Providence, Inc., 345 Harris Ave., Providence 1, R. I.	902

C

Callery Chemical Co., Callery, Pa.	C-59
Cambridge Instrument Co., Grand Central Terminal, New York 17, N. Y.	926

Now



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25TH EXPOSITION OF CHEMICAL INDUSTRIES

Exhibitors

Name of Exhibitor	*Booth No.*
Cambridge Wire Cloth Co., The, Cambridge, Md.	214
Carbon Div., Great Lakes Carbon Corp., 18 East 48th St., New York 17, N. Y.	306-308
Carborundum Co., The, Niagara Falls, N. Y.	347
Carborundum Metals Co., The, Div. of **The Carborundum Co.,** Box 32, Akron, N. Y.	347
Carlisle Gas Burners, Millville, N. J.	C-141
Carpenter Steel Co., The Alloy Tube Div., Union, N. J.	832
Carrier Conveyor Corp., 211 North Jackson St., Louisville, Ky.	117
Carver, Inc., Fred S., 1 Chatham Road, Summit, N. J.	8
Catalytic Combustion Corp., 4544 Grand River Ave., Detroit 8, Mich.	C-133
Centrico Inc., 75 West Forest Ave., P. O. Box 349, Englewood, N. J.	731
Cesco, 4025 Sebastopol Highway, Santa Rosa, Calif.	S-68
Chain Belt Co., Milwaukee 1, Wisc.	432
Chamberlain Engineering Corp., Akron, Ohio	10-12-14
Chemical Abstracts, 430 Park Ave., New York 22, N. Y.	71
Chemical Div., National Lead Co., 111 Broadway, New York 6, N. Y.	706
Chemical Engineering, 330 West 42nd St., New York 36, N. Y.	501
Chemical Engineering Catalog, 430 Park Ave., New York 22, N. Y.	71
Chemical and Engineering News, 1155 16th St. N. W., Washington 6, D. C.	1
Chemical and Engineering News, 430 Park Ave., New York 22, N. Y.	71
Chemical Engineering Progress, 25 West 45th St., New York 36, N. Y.	828
Chemical and Industrial Corp., The, 256 McCullough St., Cincinnati 26, Ohio	S-27
Chemical Materials Catalog, 430 Park Ave., New York 22, N. Y.	71
Chemical Plants Div. of Blaw-Knox Co., Pittsburgh 30, Pa.	103
Chemical Week, 330 West 42nd St., New York 36, N. Y.	501
Chemicolloid Laboratories, Inc., 55 Herricks Rd., Garden City Park, N. J.	22
Chemineer, Inc., 1044 East First St., Dayton 2, Ohio	C-155
Chempump Corp., 1300 Mermaid Lane, Philadelphia 18, Pa.	314-316
Chiksan Co., Brea, Calif.	607
Cleveland Mixer Co., The, Cannon at Aurora Roads, Bedford Heights, Cleveland, Ohio	825
Cleveland Vibrator Co., The, 2828 Clinton Ave., Cleveland 13, Ohio	S-112, S-114
Cleveland Worm & Gear Co., The, 3249-59 E. 80th St., Cleveland 4, Ohio	72
Cochrane Corp., 2108 North 17th St., Philadelphia 32, Pa.	S-111
Colonial Plastics Mfg. Co., The, Industrial Div., 8007 Grand Ave., Cleveland 4, Ohio	S-24
Colton Co., Arthur, Div. of Snyder Tool & Engineering Co., 3400 E. Lafayette Ave., Detroit 7, Mich.	301
Combustion Engineering, Inc., Raymond Div., 1315 N. Branch St., Chicago 22, Ill.	68
Commercial Filters Corp., 2 Main St., Melrose 76, Mass.	310
Conkey Filter Unit, General American Transportation Corp., 380 Madison Ave., New York 17, N. Y.	42-44
Conneaut Rubber and Plastic Corp., Conneaut, Ohio	10-12-14
Conoflow Corp., 2100 Arch St., Philadelphia 3, Pa.	639
Continental Can Co., Inc., Fibre Drum Div., 100 East 42nd St., New York 17, N. Y.	29
Continental-Diamond Fibre Co., Newark, Del.	534
Controls Div., Control Engineering Corp., 934 Washington St., Norwood, Mass.	118-122
Cooper Alloy Corp., Hillside, N. J.	602
Corning Glass Works, Corning, N. Y.	25-27
Cowles Dissolver Co., Cayuga, N. Y.	C-22
Crane Co., 836 South Michigan Ave., Chicago 5, Ill.	108
Croll-Reynolds Co., 751 Central Ave., Westfield, N. J.	234
Croll-Reynolds Engineering Co., Inc., 17 John St., New York 38, N. Y.	234
Culvert Division, Republic Steel Corp., Cleveland, Ohio	535-539
Cuno Engineering Corp., The, Meriden, Conn.	239

D

Darco Dept. Atlas Powder Co., 60 East 42nd St., New York 17, N. Y.	302-304 & 401
Davenport Machine and Foundry Co., 1628-66 West Fourth St., Davenport, Iowa	C-39
Davis Instruments Div. of Davis Emergency Equipment Co., Inc., 47 Halleck St., Newark 4, N. J.	939
Day Company, The, P. O. Box 25, Minneapolis, Minn.	5
Day Co., The J. H., Cincinnati 22, Ohio	921-925
Dean Products, Inc. Thermo-Panel Div., 1042 Dean St., Brooklyn 38, N. Y.	744
DeLaval Separator Co., The, Poughkeepsie, N. Y.	C-16
Delaware Barrel & Drum Co., Inc., P. O. Box 1648, Wilmington, Del.	C-25
Derrick Mfg. Co., 1754 Walden Ave., Buffalo 25, N. Y.	C-28
DeZurik Shower Co., Sartell, Minn.	423
Dicalite Div., Great Lakes Carbon Corp., 612 S. Flower St., Los Angeles 17, Calif.	306-308
Dore Co., John L., P. O. Box 7772, Houston 7, Tex.	C-139
Dorr-Oliver Inc., Barry Pl., Stamford, Conn.	513-517
Dowingtown Iron Works, Inc., Div of Pressed Steel Tank Co., Downingtown, Pa.	714
Dracco Corp., Harvard Ave. & E. 116th St., Cleveland 5, Ohio	808
Dudco Div., The New York Air Brake Co., 1796 East Nine Mile Rd., Detroit, Mich.	333-335
du Pont de Nemours & Co., Inc., E. I., Textile Fibers Dept., Wilmington 98, Del.	813
Duralab Equipment Corp., 979 Linwood St., Brooklyn 8, N. Y.	C-57
Durametallic Corp., 2104 Factory St., Kalamazoo, Mich.	223
Duriron Co., Inc., The, Dayton 1, Ohio	58-59
Duriron Co., Inc., The, Enzinger Div., P. O. Box 71, Angola, N. Y.	34
Durock Corp., West Pawlet, Vt.	C-153
Dust Suppression and Engineering Co., P. O. Box 67, Lake Orion, Mich.	C-163
Dustex Corp., P. O. Box 2520, Buffalo 25, N. Y.	413

E

Eastern Stainless Steel Corp., Baltimore 3, Md.	126
Eaton-Dikeman Co., Mount Holly Springs, Pa.	425
Eclipse Fuel Engineering Co., Rockford, Illinois	747
Eco Engineering Co., Div. of Economy Faucet Co., 12 New York Ave., Newark 1, N. J.	647
Eiche & Associates, Inc., R. J., 30 Church St., New York 7, N. Y.	C-123, C-127
Eimco Corp., The, 634-666 South Fourth West St., Salt Lake City 10, Utah	C-9
Electric Hotpack Co., The, Cottman Ave. at Melrose St., Philadelphia, Pa.	933
Electrode Div., Great Carbon Corp., 18 East 48th St., New York 17, N. Y.	306-308
Emery Industries, Inc., Cincinnati 2, Ohio	718
Emsco Mfg. Co., Swivel Fittings Department, P. O. Box 2098, Terminal Annex, Los Angeles 54, Calif.	C-123, C-127
Engelhard Industries, 113 Astor St., Newark 5, N. J.	C-17, C-19, C-21
Entoleter Div., The Safety Car Heating and Lighting Co., P. O. Box 904, New Haven 4, Conn.	703
Enzinger Div., The Duriron Co., P. O. Box 71, Angola, N. Y.	34
Eriez Mfg. Co., Erie 6, Pa.	C-157
Ertel Engineering Corp., Kingston, N. Y.	614

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New York 17, N. Y.

Exhibitors

Name of Exhibitor	Booth No.
Exact Weight Scale Co., The, 944 W. Fifth Ave., Columbus 8, Ohio	C-12
Exolon Co., The, Tonawanda, N. Y.	609

F

Falls Industries, Inc., Solon, Ohio	37
Farval Corp., The, 3249-59 E. 80th St., Cleveland 4, Ohio	72
Federal Refractories Corp., Mineral City, Ohio	10-12-14
Fenwal Inc., Ashland, Mass.	909
Ferranti Electric, Inc., 30 Rockefeller Plaza, New York 20, N. Y.	S-67
Filtration Engineers, Inc., 155 Oraton St., Newark 4, N. J.	3
Filtros Inc., East-Rochester, N. Y.	419
Fischbein Co., Dave, 38 Glenwood Ave., Minneapolis 3, Minn.	640
Fischer & Porter Co., Hatboro, Pa.	200, 202
Fitzpatrick Co., The W. J., 1001 West Washington Blvd., Chicago 7, Ill.	140
Fletcher Works, Inc., Glenwood Ave. & Second St., Philadelphia 40, Pa.	102
Flexitallic Gasket Co., Eighth & Bailey Sts., Camden 1, N. J.	732
Food Engineering, 330 West 42nd St., New York, N. Y.	501
Food Machinery and Chemical Corp., John Bean Div., Box 840, Lansing 4, Mich.	326
Food Machinery and Chemical Corp., Peerless Pump Div., 301 West Ave., Twenty Six, Los Angeles 31, Calif.	805
Foster Engineering Co., 835 Lehigh Ave., Union, N. J.	208
Foxboro Co., The, Foxboro, Mass.	139
Fuller Co., Fuller Bldg., Catasauqua, Pa.	213
Fulton Bag & Cotton Mills, 1400 Annunciation St., P. O. Box 198, New Orleans 3, La.	820

G

Gabb Special Products Div., The E. Horton & Son Co., Windsor Locks, Conn.	C-122
Garlock Packing Co., The, Palmyra, N. Y.	405
General Alloys Co., 367-405 West First St., Boston 27, Mass.	748
General American Transportation Corp., 135 S. LaSalle St., Chicago 90, Ill.	42-44
General Ceramics Corp., Keasbey, N. J.	37
General Electric Co., Apparatus Sales Div., 1 River Rd., Schenectady 5, N. Y.	850
General Lead Construction Corp., 1800 Harrison Ave., Kearny, N. J.	C-27
Girdler Co., The, Catalyst Dept. of Gas Processes Div., Div. of National Cylinder Gas Co., Louisville 1, Ky.	47
Girdler Co., The, Votator Div., Div. of National Cylinder Gas Co., Louisville 1, Ky.	45
Glascote Products, Inc., Subsidiary of A. O. Smith Corp., 20900 St. Clair Ave., Cleveland 17, Ohio	106
Glengarry Inc., Bay Shore, N. Y.	514
Goulds Pumps, Inc., Seneca Falls, N. Y.	C-168
Great Lakes Carbon Corp., 18 East 48th St., New York 17, N. Y.	306-308
Great Western Mfg. Co., Leavenworth, Kansas	741-743
Greif Bros. Cooperage Corp., The, P. O. Box 398, Lindenhurst, N. Y.	76
Grinnell Co., Providence 1, R. I.	50
Grip-Strut Div., The Glove Co., 4000 S. Princeton Ave., Chicago 9, Ill.	735, 737
Gross Co., F. R., 592 Crestflew Ave., Akron, Ohio	C-137
Gump, Co., B. F., 1325 S. Cicero Ave., Chicago 50, Ill.	23

H

Hamer Valves, Inc., P. O. Box 1187, Long Beach 6, Calif.	C-123, C-127
Hamilton Mfg. Co., Two Rivers, Wis.	C-161
Hanovia Chemical & Mfg. Co., 100 Chestnut St., Newark 5, N. J.	C-17, C-19, C-21
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.	917
Hardinge Co., York, Pa.	4
Hardinge Mfg. Co., 240 Arch St., York, Pa.	4
Harman Associates, F. Ward, Halesite, L. I., N. Y.	715
Hart-Carter Co., Minneapolis, Minn.	C-18
Haveg Corp., Newark, Del.	534
Haynes Stellite Co., Div. of Union Carbide and Carbon Corp., 30 East 42nd St., New York 17, New York	350
Heil Process Equipment Corp., 12901 Elmwood Ave., Cleveland 11, Ohio	622-624
Hermas Machine Co., Hawthorne, N. J.	C-117
Hercules Filter Corp., 175 Ethel Ave., Hawthorne, N. J.	78
Hewit-Robins Inc., Glenbrook P. O., Stamford, Conn.	C-14
Heyl & Patterson, Inc., 55 Fort Pitt Blvd., Pittsburgh 22, Pa.	226
HIGH PRESSURE Equipment Co., 1222 Linden Ave., P. O. Box 1174, Erie, Pa.	717
Hills-McCanna Co., 3025 North Western Ave., Chicago 18, Ill.	222
Hockmeyer & Co., Herman, 341 Coster St., New York 59, N. Y.	C-61
Hoke Inc., South Dean St., Englewood, N. J.	935
Homestead Valve Mfg. Co., Coraopolis, Pa.	S-38 & S-77
Hough Co., The Frank G., Libertyville, Ill.	69
Howe Scale Co., The, Rutland, Vt.	332
Hungerford & Terry, Inc., Clayton, N. J.	205
Hunt Machine Co., Rodney, Mills Street, Orange, Mass.	821
Hydreco Div., The New York Air Brake Co., 1100 East 222nd St., Cleveland 17, Ohio	333-335

I

Illinois Water Treatment Co., Rockford, Ill.	630
Imperial Brass Mfg. Co., The, 1200 W. Harrison St., Chicago 7, Ill.	439-441
Industrial Div., Minneapolis-Honeywell Regulator Co., Wayne & Windrim Aves., Philadelphia 44, Pa.	531
Industrial and Engineering Chemistry, 1155 16th St. N. W., Washington 6, D. C.	1
Industrial and Engineering Chemistry, 430 Park Ave., New York 22, N. Y.	71
Industrial Filter & Pump Mfg. Co., 5900 Ogden Ave., P. O. Box 151, Chicago 50, Ill.	51-53
Industrial Laboratories Publishing Co., 201 North Wells St., Chicago 6, Ill.	C-149
Industrial Steels, Inc., 255 Bent St., Cambridge 41, Mass.	726
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.	918
Insul-Mastic Corp. of America, 7750 West 61st Pl., Summit, Ill.	444
International Boiler Works Co., The, East Stroudsburg, Pa.	548
International Engineering, Inc., Dayton 1, Ohio	C-114
International Nickel Co., The, 67 Wall St., New York 5, N. Y.	507

J

Jabsco Pump Co., 2031 N. Lincoln St., Burbank, Calif.	328
Jacoby-Tarbox Corp., 808 Nepperhan Ave., Yonkers, N. Y.	632
Jarrell-Ash Co., 26 Farwell St., Newtonville 60, Mass.	C-164
Jeffrey Mfg. Co., The, Columbus 16, Ohio	201
Jenkins Bros., 100 Park Ave., New York 17, N. Y.	147
Jerguson Gage & Valve Co., 87 Fellsway, Somerville 45, Mass.	C-132
Johns-Manville Sales Corp., 22 East 40th St., New York 16, N. Y.	508
Journal of Agricultural and Food Chemistry, 1155 16th St. N. W., Washington 6, D. C.	1
Journal of Agricultural and Food Chemistry, 430 Park Ave., New York 22, N. Y.	71

K

Kanigen Div., General American Transportation Corp., 135 S. LaSalle St., Chicago 90, Ill.	42-44
Kellogg Co., The M. W., Chemical Mfg. Div., P. O. Box 469, Jersey City 3, N. J., **Chemical Process Div.,** 225 Broadway, New York 7, N. Y.	835-839-843

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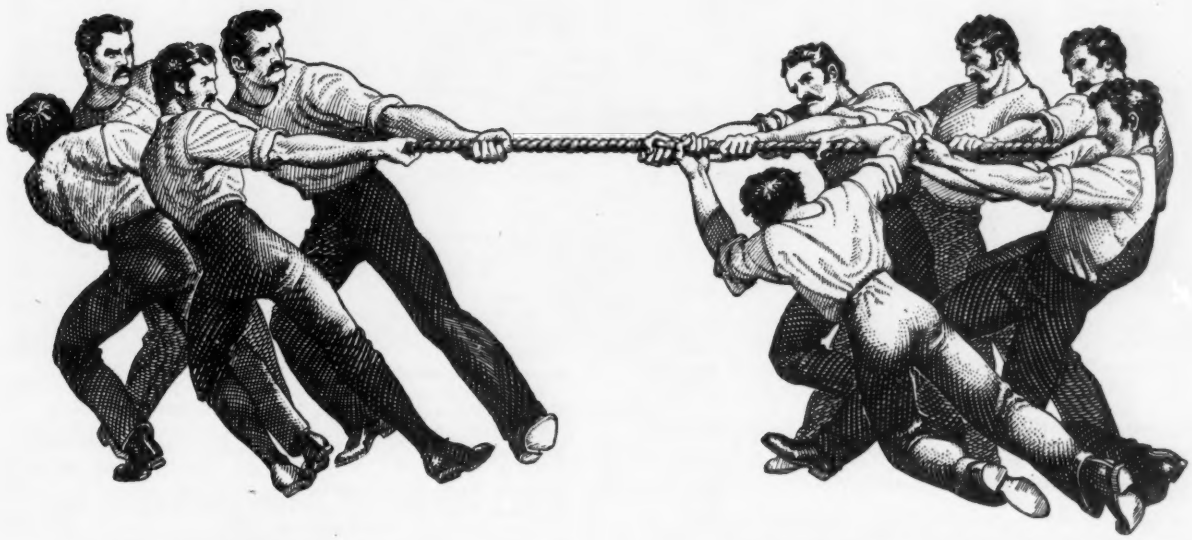

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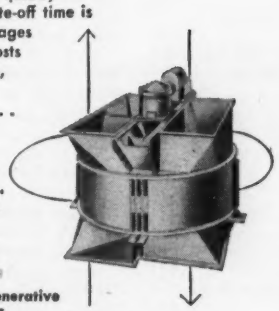

The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves, the heat is transferred from the waste gases to the incoming cold air.

Recover waste heat, return it to the furnace as combustion air, and you naturally generate higher flame temperatures . . . increase heat-transfer rates — *which means more through-put.*

That's why four of your present processing units can do the work of five *with Ljungstrom Air Preheaters increasing each unit's output as much as 25%.* One eastern refinery increased the continuous capacity of a pipe still from 16,000 to 18,000/20,000 barrels a day — by modernizing and including a Ljungstrom.

The Air Preheater Corporation **60 East 42nd Street, New York 17, N. Y.**

Exhibitors

Name of Exhibitor	*Booth No.*
Kewaunee Mfg. Co., Adrian, Mich.	707
Kimble Glass Co., Toledo 1, Ohio	408
Kinetic Dispersion Corp., 95 Botsford Pl., Buffalo 16, N. Y.	C-118
Kinney Mfg. Co., Subsidiary of The New York Air Brake Co., 3529-3541 Washington St., Boston 30, Mass.	333-335
Knapp Mills, Inc., 23-15 Borden Ave., Long Island City 1, N. Y.	19
Knight, Maurice A., Kelly Ave., Akron, Ohio	7
Komline-Sanderson Engineering Corp., Peapack, N. J.	C-151
Kontes Glass Co., Vineland, N. J.	C-154
Koppers Co., Metal Products Div., Precipitator Dept., 200 Scott St., Baltimore, Md.	121-125
Koven & Brother, Inc., L. O., 154 Ogden Ave., Jersey City 7, N. J.	834

L

Laboratory Equipment Corp., P. O. Box 352, St. Joseph, Mich.	C-124
Laboratory Furniture Co., Inc., Old Country Rd., P. O. Box 590, Mineola, N. Y.	414
Laboratory Glass Supply Co., 610 West 150th St., New York 31, N. Y.	C-135
LaBour Co., The, Elkhart, Ind.	31
Ladish Co., Cudahy, Wis.	24
Ladish Co., Tri-Clover Div., Kenosha, Wis.	26
Lapp Insulator Co., Inc., Process Equipment Div., Leroy, N. Y.	814
Lawrence Pumps, Inc., 371 Market St., Lawrence, Mass.	320-322
Lead Lined Iron Pipe Co., Wakefield, Mass.	210
Lebanon Steel Foundry, Labanon, Pa.	134
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia 44, Pa.	734
Lehmann Company, Inc., J. M., 550 New York Ave., Lyndhurst, N. J.	C-43
Leslie Co., Lyndhurst, N. J.	C-31
Link-Belt Co., 307 N. Michigan Ave., Chicago 1, Ill.	532
Liston-Becker Plant, Beckman Instruments, Inc., 649 Hope St., Springdale, Conn.	836
Logan Emergency Showers, Inc., P. O. Box 111, Glendale, Calif.	C-142
Louisville Drying Machinery Co., Unit, General American Transportation Corp., 139 S. Fourth St., Louisville, Ky.	42-44
Lovejoy Flexible Coupling Co., 4949 W. Lake Street, Chicago 44, Ill.	448
Lukens Steel Co., Coatesville, Pa.	66
Luzerne Rubber Co., The, Trenton 7, N. J.	409

M

Machlett & Son, E., 220 East 23rd St., New York 10, N. Y.	C-33
Magnetic Engineering & Mfg. Co., 851 Van Houten Ave., Clifton, N. J.	236
Magnetrol, Inc., 2110 S. Marshall Blvd., Chicago 23, Ill.	431
Manton-Gaulin Mfg. Co., 44 Garden St., Everett 49, Mass.	406
Marco Co., Saginaw, Mich.	540-544
Martin & Co., H. S., 1919-20 Greenleaf St., Evanston, Ill.	C-138 & C-140
Martinson Machine Co., 412 Harrison St., Kalamazoo, Mich.	C-136
Master Electric Co., The, Dayton 1, Ohio	57
Materials and Methods, 430 Park Ave., New York 22, N. Y.	71
McGraw-Hill Book Co., 330 West 42nd St., New York 36, N. Y.	427
McGraw Hill Publishing Co., 330 West 42nd St., New York 36, N. Y.	501
Merco Centrifugal Co., 150 Green St., San Francisco 11, Calif.	2
Metal Textile Corp., 647 East First Ave., Roselle, N. J.	C-65
Metalab Equipment Corp., Div. of Norbute Corp., Hicksville, N. Y.	901
Mettler Instrument Corp., Box 242, Hightstown, N. J.	18
Metalweld, Inc., Scotts Lane & Abbotsford Ave., Philadelphia 29, Pa.	240
Mic-Lin Co., Cornell Ave., Merchangville, N. J.	S-71
Miller & Son, Inc., Franklin P., SUPREME Crusher Div., 36 Meadow St., East Orange, N. J.	S-31
Milton Roy Company, 1300 East Mermaid Lane, Chestnut Hill, Philadelphia 18, Pa.	313
Mine Safety Appliances Company, 201 North Braddock Ave., Pittsburgh 8, Pa.	C-34
Minerals & Chemicals Corp. of America, Menlo Park, N. J.	807
Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne & Windrim Aves., Philadelphia 44, Pa.	531
Misco Fabricators, Inc., 1999 Guoin St., Detroit 7, Mich.	723
Mission Mfg. Co., Centrifugal Pump Div., P. O. Box 4209, Houston 14, Texas	C-147
Missouri Coke & Chemical Div., Great Lakes Carbon Corp., 3570 Lindell Blvd., St. Louis 3, Mo.	306-308
Mixing Equipment Co., 135 Mt. Read Blvd., Rochester 11, N. Y.	800
Monarch Mfg. Works, Inc., 2501 E. Ontario St., Philadelphia 34, Pa.	701
Morehouse-Cowles Inc., 1156 San Fernando Rd., Los Angeles 65, Calif.	C-22
Mud Products Inc., Phil-Towder Bldg., Tulsa, Okla.	824
Multi Metal Wire Cloth Co., Inc., 1350 Garrison Ave., New York 59, N. Y.	204
Murray Co., A. B., Elizabeth, N. J.	S-32
Murray Tube Works, Inc., The, Elizabeth, N. J.	S-32

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Naresco Equipment Corp., Subsidiary of National Research Corp., 160 Charlemont St., Newton Highlands 61, Mass.	C-115
Nash Engineering Co., The, South Norwalk, Conn.	400
National Carbon Co., Div. of Union Carbide and Carbide Corp., 30 East 42nd St., New York 17, N. Y.	350
National Drying Machinery Co., The, Lehigh Ave. & Hancock St., Philadelphia 33, Pa.	C-62
National Dust Collector Corp., 549 West Washington Blvd., Chicago 6, Ill.	232
National Engineering Co., Simpson Mix-Muller Div., 549 West Washington Blvd., Chicago 6, Ill.	232
National Filter Media Corp., The, 1717 Dixwell Ave., New Haven 14, Conn.	616
National Lead Co., 111 Broadway, New York 6, N. Y.	702, 706, 708
National Rosin Oil Products, Inc., Savannah, Ga.	64
National Tube Div., United States Steel Corp., 525 William Penn Pl., Pittsburgh 30, Pa.	518-522
Neumann & Weaver, Inc., 22-12 Raphael St., Fair Lawn, N. J.	C-169
Newark Wire Cloth Co., 351 Verona Ave., Newark 4, N. J.	334
New Brunswick Scientific Co., P. O. Box 606, New Brunswick, N. J.	626
New England Tank & Tower Co., Everett, Mass.	52
New York Air Brake Co., The, 230 Park Ave., New York 17, N. Y.	333-335
New York Laboratory Supply Co., Inc., 76 Varick St., New York 13, N. Y.	C-41
Niagara Blower Co., 405 Lexington Ave., New York 17, N. Y.	600
Niagara Filters Div., American Machine and Metals, Inc., East Moline, Ill.	802-806
Nichols Engineering & Research Corp., 70 Pine St., New York 5, N. Y.	631
Nicholson & Co., W. H., 12 Oregon St., Wilkes-Barre, Pa.	132
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio	535-539
Nordstrom Valve Div., Rockwell Mfg. Co., 400 North Lexington Ave., Pittsburgh 8, Pa.	617
North American Philips Co., 750 South Fulton Ave., Mt. Vernon, N. Y.	648

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Okadee Valve Co., 332 So. Michigan Ave., Chicago, Ill.	824
Omega Machine Co., 345 Harris Ave., Providence 1, R. I.	902
Oronite Chemical Co., 200 Bush St., San Francisco 20, Calif.	C-23
Owens-Corning Fiberglas Corp., Toledo 1, Ohio	618-620

P

Pangborn Corp., Hagerstown, Md.	906
Parker Appliance Co., The, 17325 Euclid Ave., Cleveland 12, Ohio	74
Parks-Cramer Co., Fitchburg, Mass.	727
Patterson Foundry & Machine Co., The, East Liverpool, Ohio	331
Patterson-Kelley Co., The, East Stroudsburg, Pa.	739, 831
Peabody Engineering Corp., 580 Fifth Ave., New York 36, N. Y.	C-116
Peerless Pump Div., Food Machinery and Chemical Corp., 301 West Ave. Twenty Six, Los Angeles 31, Calif.	805
Penberthy Injector Co., Div., of Buffalo-Eclipse Corp., 1242 Holden Ave., Detroit 2, Mich.	426
Perkin-Elmer Corp., The, Norwalk, Conn.	705
Perlite Div., Great Lakes Carbon Corp., 612 South Flower St., Los Angeles 17, Calif.	306-308
Permutit Co., The, 330 West 42nd St., New York 36, N. Y.	73
Perry Products Co., 1421 North Sixth St., Philadelphia 22, Pa.	437
Petro-Chem Development Co., Inc., 122 East 42nd St., New York 17, N. Y.	C-44
Pfaudler Co., The, 1000 West Ave., Rochester 3, N. Y.	502
Pharmaceutical and Chemical Industry Supply Corp., 16 Hudson St., New York 13, N. Y.	C-55
Philadelphia & Suburban Tire Service, 6215 Baltimore Ave., Yeadin, Pa.	S-115
Philadelphia Gear Works, Inc., G St. below Erie Ave., Philadelphia 34, Pa.	33
Philadelphia Pump & Machinery Co., 1513 Race St., Philadelphia, Pa.	C-130
Photovolt Corp., 95 Madison Ave., New York 16, N. Y.	635
Pittsburgh Corning Corp., One Gateway Center, Pittsburgh 22, Pa.	38
Pla-Tank, Inc., Div. of **The Chemical Corp.,** West Warren, Mass.	C-120
Plate & Welding Div., General American Transportation Corp., 135 S. La Salle St., Chicago 90, Ill.	42-44
Platecoil Div., Tranter Mfg., Inc., Lansing 4, Mich.	340-342-344
Pneumatic Scale Corp., Ltd., 65 Newport Ave., North Quincy 71, Mass.	77
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Poly-Seal Corp., The, 405 Lexington Ave., New York 17, N. Y.	S-28
Popper & Sons, Inc., 300 Fourth Ave., New York 10, N. Y.	907
Porter Co., H. K. Watson-Stillman Fittings Div., P. O. Box 95, Roselle, N. J.	722
Potter Aeronautical Co., P. O. Box 532, Route 22, Union, N. J.	C-40
Potts Co., Horace T., Speedline Stainless Steel Fittings Div., Erie Ave. & "D" St., Philadelphia 34, Pa.	307
Powell Co., The Wm., 2503-31 Spring Grove Ave., Cincinnati 22, Ohio	48
Prater Pulverizer Co., 1515 S. 55th Court, Chicago 50, Ill.	336-338
Precision Scientific Co., 3737 West Cortland St., Chicago 47, Ill.	67
Precision Thermometer & Instrument Co., 1434 Brandywine St., Philadelphia 30, Pa.	S-66
Premier Mill Corp., Geneva, N. Y.	309
Pressed Steel Tank Co., 1445 So. 66 St., West Allis 14, Wis.	714
Pressure Products Industries, Inc., Hatboro, Pa.	C-37
Proctor & Schwartz, Inc., 7th St., & Tabor Road, Philadelphia 20, Pa.	950
Productive Equipment Corp., 2926 W. Lake St., Chicago 12, Ill.	207
Progressive Architecture, 430 Park Ave., New York 22, N. Y.	71
Proportioneers, Inc., 345 Harris Ave., Providence 1, R. I.	902
Protectoseal Co., The, 1920 South Western Ave., Chicago 8, Ill.	C-38
Pulva Corp., 550 High St., Perth Amboy, N. J.	330
Pulverizing Machinery Div., Metals Disintegrating Co., Inc., Chatham Road, Summit, N. J.	C-30
Putman Publishing Co., 111 E. Delaware Pl., Chicago 11, Ill.	610

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Quaker Oats Co., The Electrostatic Div. of Mechanical Research Dept., Mohawk Bldg., 205 Water St., Akron 8, Ohio	15
Quelcor, Inc., Front & Broomall Sts., Chester, Pa.	348

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Republic Lead Equipment Co., Cleveland, Ohio	10-12-14
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio	535-539
Research Controls, P. O. Box 5035, Tulsa, Okla.	C-134
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Reynolds Metals Co., 2500 South Third St., Louisville 1, Ky.	436
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Rietz Mfg. Co., 150 Todd Road, Santa Rosa, Calif.	719, 721
Robbins & Myers, Inc., Pump Div., Springfield, Ohio	32
Rochester Mfg. Co., Inc., Rochester 10, N. Y.	422
Rockwell Mfg. Co., 400 North Lexington Ave., Pittsburgh 8, Pa.	617
Ross & Son Co., Charles, 148-156 Classon Ave., Brooklyn 5, N. Y.	447
Roth Co., Roy E., 2420 Fourth Ave., Rock Island, Ill.	S-37
Rotherm Engineering Co., Inc., 7280 West Devon Ave., Chicago 31, Ill.	C-143
Rubicon Co., Ridge Ave. at 35th St., Philadelphia 32, Pa.	745
Ruggles-Coles Engineering Co., 240 Arch St., York, Pa.	4

S

Sadtler & Son, Inc., Samuel P., 1517 Vine St., Philadelphia 2, Pa.	C-144
Safety Car Heating and Lighting Co., The Entoleter Div., P. O. Box 904, New Haven 4, Conn.	703
Saran Lined Pipe Co., 2415 Burdette Ave., Ferndale, Mich.	343
Sarco Co., Empire State Bldg., New York 1, N. Y.	C-128
Sauereisen Cements Co., Pittsburgh 15, Pa.	S-26
Schneible Co., Claude B., P. O. Box 81, North End Station, Detroit 2, Mich.	900
Schutz-O'Neill Co., 307 Portland Ave., Minneapolis 15, Minn.	418
Scientific Development Co., Box 795, State College, Pa.	713
Scientific Glass Apparatus Co., 100 Lakewood Terrace, Bloomfield, N. J.	54
Scott Aviation Corp., Lancaster, N. Y.	C-159
Sealol Corp., 45 Willard Ave., Providence 5, R. I.	S-25
Selas Corp. of America, Erie Ave. & D St., Philadelphia 34, Pa.	62
Sel-Rex Precious Metals, Inc., Belleville 9, N. J.	S-107
Sharples Corp., The, 2300 Westmoreland St., Philadelphia 40, Pa.	C-29
Sharples Corp. Research Laboratories, The, 424 W. Fourth St., Bridgeport, Pa.	C-29
Sheldon Equipment Co., E. H. Muskegon, Mich.	136

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Simplicity Engineering Co., Durand, Mich.	822
Simpson Mix-Muller Div., National Engineering Co., 549 West Washington Blvd., Chicago 6, Ill.	232
Sly Mfg. Co., The W. W., 4700 Train Ave., Cleveland 1, Ohio	43
Snyder Tool & Engineering Co., Arthur Colton Co., Div., 3400 E. Lafayette Ave., Detroit 7, Mich.	301
Southwestern Engineering Co., 4800 Santa Fe Ave., Los Angeles 58, Calif.	C-56, C-58
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Speedline Stainless Steel Fittings Div., Horace T. Potts Co., Erie Ave. & "D" St., Philadelphia 34, Pa.	307
Sperry & Co., D. R. Batavia, Ill.	632
Spraying Systems Co., 3201 Randolph St., Bellwood, Ill.	833
Sprout, Waldron & Co., Muncy, Pa.	109-111-113
Standard Steel Corp., 5001 Boyle Ave., Los Angeles 58, Calif.	801
Star Tank and Filter Corp., 875 Edgewater Rd., New York 59, N. Y.	129
Steel and Tubes Div., Republic Steel Corp., Cleveland, Ohio	535-539
Stoffel Seals Corporation Tuckahoe, N. Y.	S-73
Stokes Machine Co., F. J., Philadelphia 20, Pa.	910
Strahman Valves, Inc., 16 Hudson St., New York 13, N. Y.	C-24
Sturtevant Mill Co., Park & Clayton Sts., Dorchester, Boston 22, Mass.	905
Superior Electric Company, The, Bristol, Conn.	C-13
Superior Tube Co.,Norristown, Pa.	346
Swenson Evaporator Co., Div. of Whiting Corp., Harvey, Ill.	932

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Tank Car Div., General American Transportation Corp., 135 S. La Salle St., Chicago 90, Ill.	42-44
Tank Storage Div., General American Transportation Corp., 135 South La Salle St., Chicago 90, Ill.	42-44
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Toledo Porcelain Enamel Products Co., Toledo, Ohio	824
Toledo Scale Co., Toledo 1, Ohio	750
Tolhurst Centrifugals Div., American Machine and Metals, Inc., E. Moline, Ill.	802-806
Torsion Balance Co., The, Clifton, N. J.	847
Tote System, Inc., Beatrice, Neb.	605
Tranter Mfg., Inc., Lansing 4, Mich.	340-342-344
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Treen Box Co., Tioga and Memphis St., Philadelphia 34, Pa.	S-72
Trent, Inc., 201-299 Leverington Ave., Philadelphia 27, Pa.	803
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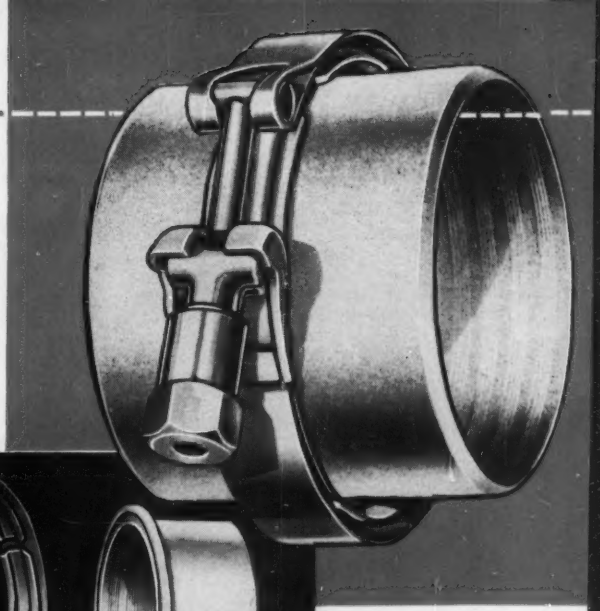

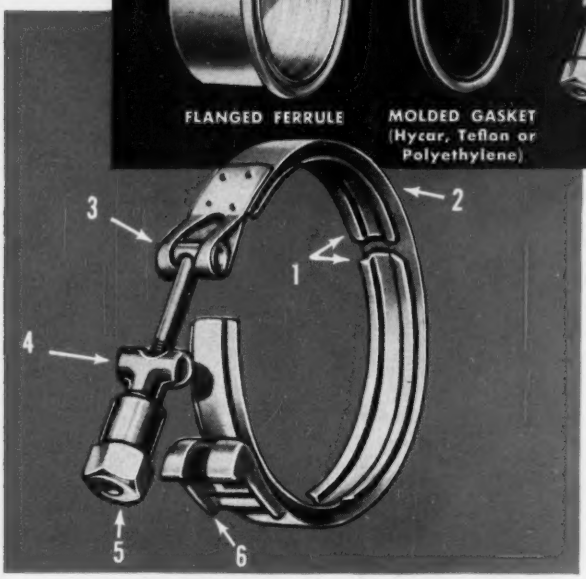

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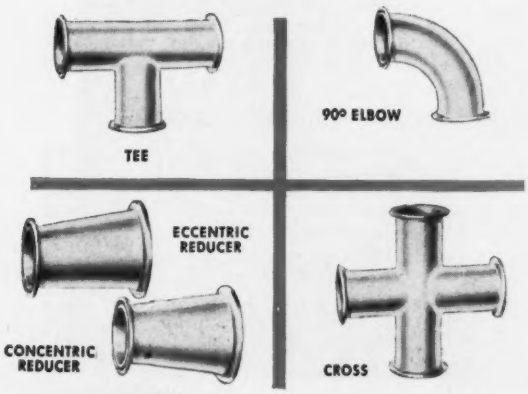

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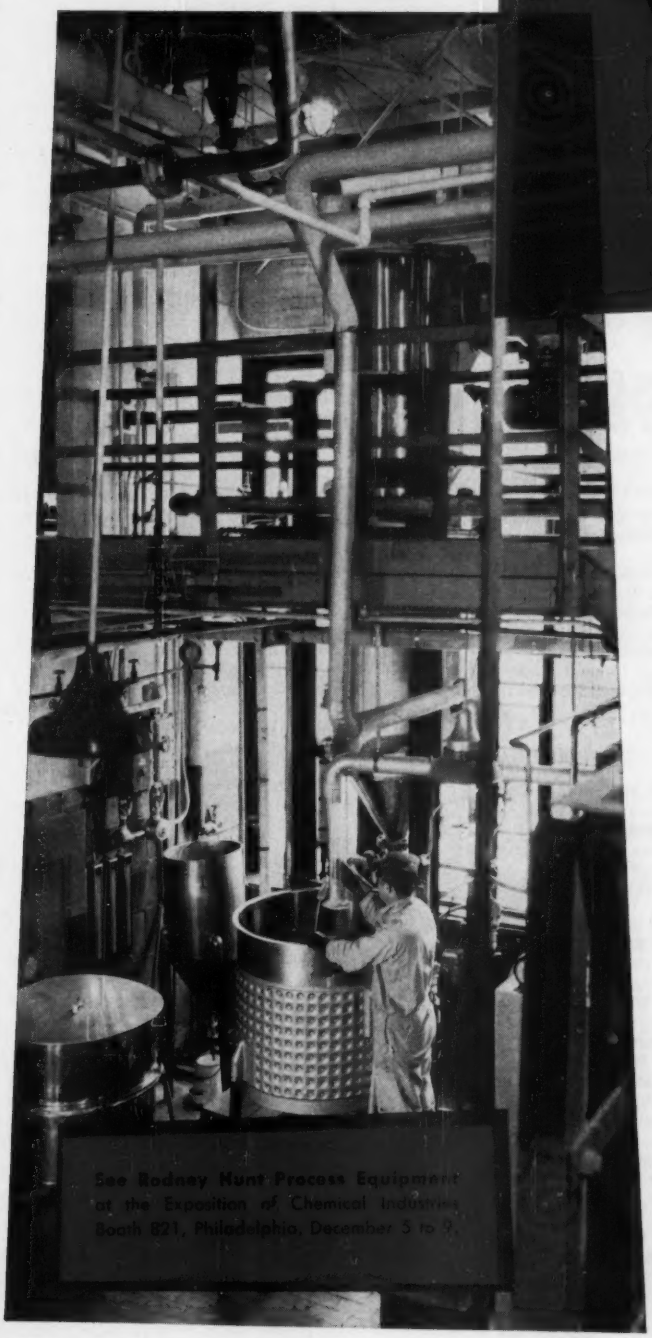

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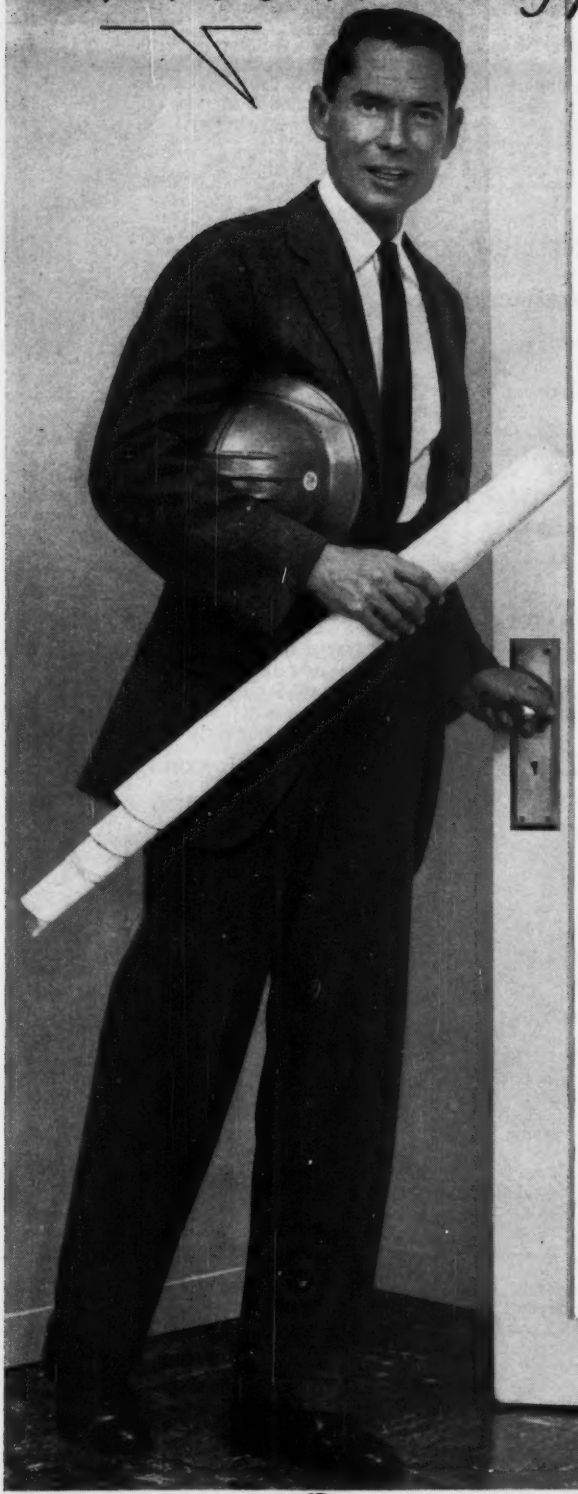

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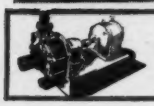
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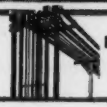
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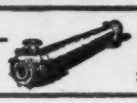
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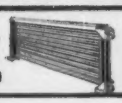
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Patterson-Kelly Co., The 739-831
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Sturtevant Mill Co. 905
Terriss Div., Consolidated Siphon Supply Co. 244
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Thropp & Sons, Wm R., Div. of J. M. Lehmann Co. C-43
Tolhurst Centrifugals Div., American Machine & Metals, Inc. 802-806
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Treadwell Construction Co. 729
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Metalab Equipment Co., Div. of Norbute Corp. 901
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Bishop & Co., Platinum Works, J. ..809
Callery Chemical Co. C-59
Carborundum Metals Co., The, Div. of The Carborundum Co. 347
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Minerals & Chemicals Corp. of America 807
National Lead Co. 702-706-708
Oronite Chemical Co. C-23
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Reynolds Metals Co. 436
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Bishop & Co., J., Platinum Works. .809
Callery Chemical Co. C-59
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American Tool & Machine Co. 826
American Water Softener Co. S-64
American Well Works, The C-160
Atlas Powder Co., Chemicals Div. 302-304 & 401
Centrico, Inc. 731
Chain Belt Co. 432
Cleveland Mixer Co., The 825
Croll-Reynolds Engineering Co., Inc. 234
De Laval Separator Co., The C-16
Dicalite Division, Great Lakes Carbon Corp. 306-308
Dorr-Oliver Inc. 513-517
Hardinge Company, Inc. 4
Heyl & Patterson, Inc. 226
Hungerford & Terry, Inc. 205
Illinois Water Treatment Co. 630
Johns-Manville Sales Corp. 508
Merco Centrifugal Co. 2
Permutit Co., The 73
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Heyl & Patterson, Inc. 226
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Merco Centrifugal Co. 2
Nichols Engineering & Research Corp. 631
Prater Pulverizer Co. 336-338
Sharples Corp. C-29
Sprout, Waldron & Co., Inc. .109-111-113
Sturtevant Mill Co. 903
Tolhurst Centrifugals Div., American Machine & Metals, Inc. 802-806
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Lovejoy Flexible Coupling Co. 448

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Missouri Coke & Chemical Div., Great Lakes Carbon Corp. 306-308

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Atlas Mineral Products Co., The 415-417
General Ceramics Corp. 37
Heil Process Equipment Corp. 622-624
Industrial Filter & Pump Mfg. Co. 51-53
Insul-Mastic Corp. of America 444
Johns-Manville Sales Corp. 508
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MW Protective Coatings Div., Metalweld, Inc. 240
National Lead Co. 702-706-708
Saran Lined Pipe Co. 343
United States Stoneware Co., The 10-12-14

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Haynes Stellite Co., Div. of Union Carbide and Carbon Corp. 350
Knapp Mills, Inc. and Andrews-Knapp Construction Co., Inc. 19
Lead Lined Iron Pipe Co. 210
Murray Co., A. B. S-32
Perry Products Co. 437
Platecoil Div., Tranter Mfg., Inc. 340-342-344
Terriss Div., Consolidated Siphon Supply Co. 244
Thermo-Panel Div., Dean Products, Inc. 744
Treadwell Construction Co. 729
Vogt Machine Co., Henry 56

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Emsco Mfg. Co. C-123, C-127
Podbielniak, Inc. 601

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American Air Filter Co. 150-250
Chain Belt Co. 432
Colton Co., Arthur 301
Day Co., The 5
Dracco Corp. 808
Koppers, Inc., Metal Products Div. Precipitator Dept. 121-125
Link Belt Co. 532
National Dust Collector Corp., Div. National Engineering Co. 232
Pangborn Corp. 906
Pulverizing Machinery Div., Metals Disintegrating Co. C-30
Schneible Co., Claude B. 900
Sharples Corp., The C-29
Sprout, Waldron & Co., Inc. .109-111-113

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TYPE	Description and Application
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GROUP I	Martensitic—straight chromium, hardenable. Machineable. Weldable. Magnetic.
403	High stress rotating parts. Turbine blades.
410	Valve trim, oil refinery equipment, pump shafts.
416	Pinions, gears, shafts, aircraft fittings.
GROUP II	Ferritic—straight chromium, non-hardenable. Machineable. Magnetic. Corrosion resistance superior to Group I.
430	Trim work exposed to atmosphere or water. Hardware.
442, 3, 6	Scale resisting. Furnace parts, baffles, blowers, trays.
GROUP III	Austentic—chromium—nickel—non-hardenable.
302	Heat treating fixtures.
303	Food machinery equipment.
304	Dairy equipment. Magnetic traps.
305	Textile equipment.
309	Chemical equipment. Pump parts.
316	Chemical equipment. Condensers.
347	Pressure fittings.
WAUKESHA METAL	
	Copper base, high nickel content, corrosion-resisting alloy.
0	For high hardness. High tensile characteristics. Good wearing qualities.
1	Recommended for frictional parts.
3	Rather hard. Recommended for conveyor chain links, cams.
18	Recommended for use on shafts and applications involving pressure and high tensile strength.
23	Bearing alloy to be used in conjunction with stainless steel alloys for non-galling applications.
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Monel	Developed to meet requirements for specific application of corrosion resistance and bearing qualities.
Pure Nickel	Very high corrosion resistance.
Inconel	For specific corrosion resistance applications.
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Everdur	Silicon bronze alloy. Corrosion resistance properties of copper and physical properties of mild steel.
Brass and Bronze	All grades available.
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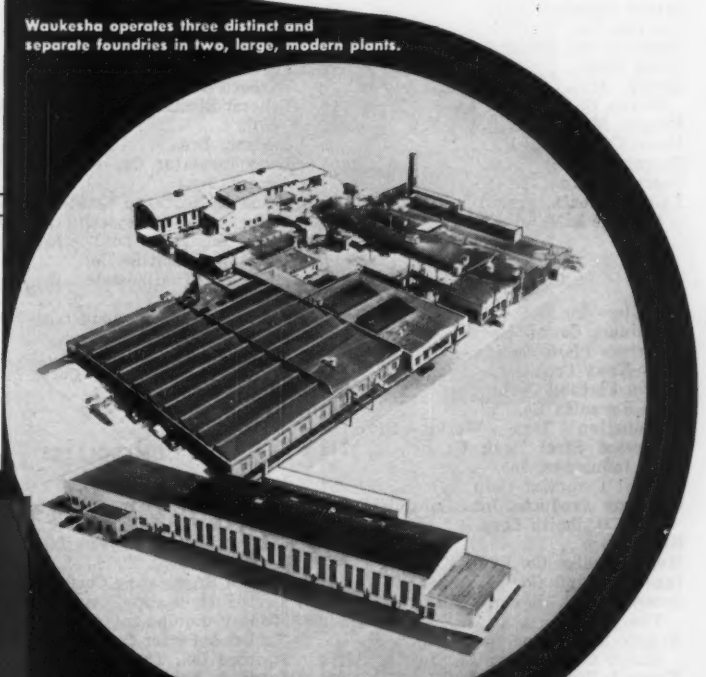

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COLLOID MILLS

Chemicolloid Laboratories, Inc. 22
Fitzpatrick Co., The W. J. 140
Kinetic Dispersion Corp. C-118
Manton-Gaulin Mfg. Co. 406
Morehouse-Cowles, Inc. C-22
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Tri-Homo Corp. 305
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American Instrument Co. 736
Brinkman & Company, C. A. C-36
Fischer & Porter Co. 200-202
Machlett & Son, E. C-33
New York Laboratory Supply Co. ..C-41
Photovolt Corp. 635
Scientific Glass Apparatus Co. 54
Technicon Co., The C-32

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Perkins-Elmer Corp., The 705
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Ingersoll-Rand Co. 918
Knapp Mills, Inc. and Andrews-Knapp Construction Co. 19
Nash Engineering Co., The 400
Worthington Corp. 840-848
York Corp., Industrial Div. 402

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Carrier Conveyor Corp. 117
Centrico, Inc. 731
Chemical and Industrial Corp., The S-27
Haveg Corp. 534
Knapp Mills, Inc. and Andrews-Knapp Construction Co. 19
Knight, Maurice A. 7
Merco Centrifugal Co. 2
Niagara Blower Co. 600
Sharples Corp., The C-29
Tolhurst Centrifugals Div. American Machine & Metals, Inc. 802-806

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Aluminum Co. of America 233-235
American Plant Equipment Co. S-65
Blaw-Knox Co. 103
Brown Fintube Co. 948
Croll-Reynolds Co. 234
Downington Iron Works Div., Pressed Steel Tank Co. 714
Falls Industries, Inc. 37
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Haveg Corp. 534
Hunt Machine Co. Rodney 821
Ingersoll-Rand Co. 918
International Boiler Works, Co., The 548
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Koven & Brother, Inc., L. O. 834
Niagara Blower Co. 600
Patterson-Kelly Co., The 739-831
Star Tank & Filter Corp. 129
Stokes Machine Co., F. J. 910
Thermo-Panel Div., Dean Products, Inc. 744
Treadwell Construction Co. 729
Vogt Machine Co., Henry 56
Welch Mfg. Co., W. M. C-42
York Corp., Industrial Div. 402

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Allis-Chalmers Mfg. Co. 934
Automatic Switch Co. 646
General Electric Co., Apparatus Sales Div. 850
Podbielniak, Inc. 601
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General Lead Construction Corp. C-27
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Haveg Corp. 534
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Allis-Chalmers Mfg. Co. 934
Automatic Switch Co. 646
BIF Industries, Inc. 902
Brookfield Engineering Laboratories, Inc. 424
Brooks Rotameter Co. 606
Conoflow Corp. 639
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Davis Instruments Div. of Davis Emergency Equipment Co. 939
Electric Hotpack Co., The 933
Fischer & Porter Co. 200-202
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General Electric Co., Apparatus Sales Div. 850
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Chain Belt Co. 432
Day Co., The J. H. 921-925
Dracco Corp. 808
Fuller Co. 213
General American Transportation Corp. 42-44
Great Western Mfg. Co. 741-743
Hewitt-Robins Inc. C-14
Jeffrey Manufacturing Co., The 201
Koven & Brother, Inc., L. O. 834
Link-Belt Co. 532
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Proctor & Schwartz, Inc. 950
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Simpson Mix-Muller Div., National Engineering Co. 232
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Downington Iron Works, Inc., Div. of Pressed Steel Tank Co. 714
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Niagara Blower Co. 600
Patterson-Kelley Co., The 739, 831
Peabody Engineering Corp. C-116
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Thermo-Panel Div., Dean Products, Inc. 744
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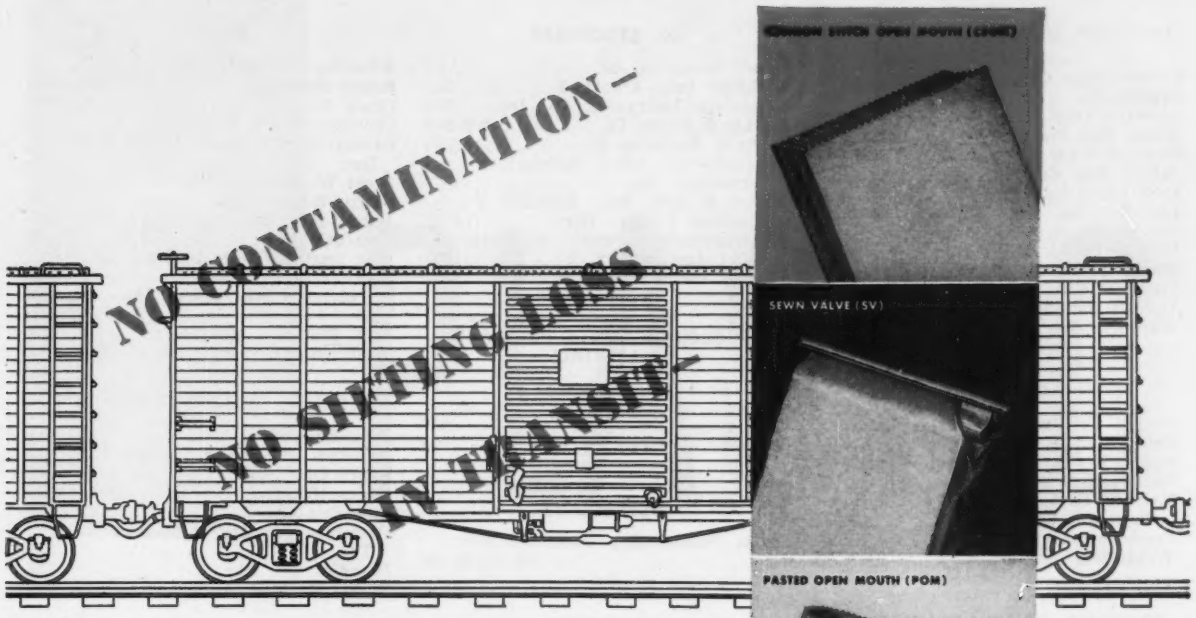

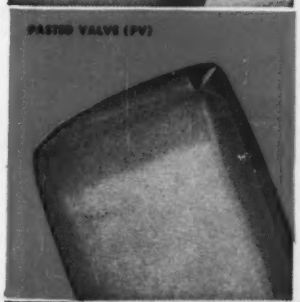

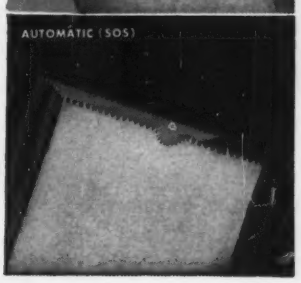

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Chiksan Co. 607
Doré Co., John L. C-139
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Imperial Brass Mfg. Co., The 439-441
Jeffrey Mfg. Co., The 201
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Lovejoy Flexible Coupling Co. 448
Murray Co., A. B. S-32
Philadelphia Gear Works, Inc. 33
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National Carbon Co., Div. of Union Carbide & Carbon Corp. 350
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Hardinge Co. 4
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Pulva Corp. 330
Pulverizing Machinery Div., Metals Disintegrating Co. C-30
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Ross & Son Co., Charles 447
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Scientific Glass Apparatus Co. 54
Sprout, Waldron & Co., Inc. .. 109-111-113
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Thropp & Sons, Wm. R., Div. of J. M. Lehmann Co. C-43
Tri-Homo Corp. 305
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General Ceramics Corp. 37
Haveg Corp. 534
Rietz Manufacturing Co. 719-721
Treadwell Construction Co. 729
Vogt Machine Co., Henry 56
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Blaw-Knox Co. 103
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Minerals & Chemicals Corp. of America 807
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Dorr-Oliver Inc. 513-517
Hardinge Co. 4
Haveg Corp. 534
Koven & Brother, Inc., L. O. 834
Misco Fabricators, Inc. 723
National Lead Co. 702-706-708
Patterson Foundry & Machine Co., The 331
Ross & Son Co., Charles 447
Treadwell Construction Co. 729

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American Well Works, The C-160
Baker-Perkins, Inc. 540-544
Bartlett & Snow Co., The C. O. 247
Cleveland Mixer Co., The 825
Fitzpatrick Co., The W. J. 140
Haveg Corp. 534
Hockmeyer & Co., Herman C-61
Kinetic Dispersion Corp. C-118
Koven & Brother, Inc., L. O. 834
Morehouse-Cowles, Inc. C-22
New England Tank & Tower Co. 52
Patterson Foundry & Machine Co., The 331
Patterson-Kelley Co., The 739-831
Ross & Son Co., Charles 447

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Ace Glass Inc. 710
American Instrument Co. 736
Barnebey-Cheney Co. 17
Barnstead Still & Sterilizer Co. 636
Blaw-Knox Co. 103
Electric Hotpack Co., The 933
Glascote Products, Inc., Subsidiary of A. O. Smith Corp. 106
Haveg Corp. 534
Laboratory Glass Supply Co. C-135
Machlett & Son, E. C-33
Martin & Co., H. S. C-138, C-140
Patterson-Kelley Co., The 739-831
Pfaudler Co. 502
Podbielniak, Inc. 601
Precision Scientific Co. 67
Scientific Development Co. 713
Star Tank & Filter Corp. 129
Treadwell Construction Co. 729
Welch Manufacturing Co., W. M. ... C-42
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Allis-Chalmers Mfg. Co. 934
Bailey Meter Co. 30
Chain Belt Co. 432
Cleveland Worm & Gear Co., The 72
General Electric Co., Appratus Sales Div. 850
Great Western Mfg. Co. 741-743
Hewitt-Robins Inc. C-14
Jeffrey Mfg. Co., The 201
Link-Belt Co. 532
New England Tank & Tower Co. 52
New York Air Brake Co. 333
Philadelphia Gear Works, Inc. 33
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Davenport Machine & Foundry Co. .. C-39
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Patterson Foundry & Machine Co., The 331
Pfaudler Co., The 502
Stokes Machine Co., F. J. 910

DRYERS, CENTRIFUGAL

American Tool & Machine Co. 826
Baker-Perkins, Inc. 540-544
Bird Machine Co. 321-325
Blaw-Knox Co. 103
Merco Centrifugal Co. 2
Nichols Engineering & Research Corp. 631
Sharples Corp., The C-29
Sturtevant Mill Co. 905
Tolhurst Centrifugals Div., American Machine & Metals Inc. 802-806

DRYING MACHINERY & EQUIPMENT

Allis-Chalmers Mfg. Co. 934
American Instrument Co. 736
Bartlett & Snow Co., The C. O. 247
Blaw-Knox Co. 103
Bowen Engineering, Inc. 613
Carrier Conveyor Corp. 117
Carver, Inc., Fred S. 8
Cleveland Mixer Co., The 825
Combustion Engineering, Inc., Raymond Div. 68
Davenport Machine & Foundry Co. .. C-39
Dorr-Oliver Inc. 513-517
Electric Hotpack Co., The 933
Eimco Corp., The C-9
Emsco Mfg. Co. C-123, C-127
General American Transportation Corp. 42-44
Glascote Products, Inc., Subsidiary of A. O. Smith Corp. 106
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Heyl & Patterson, Inc. 226
Hunt Machine Co., Rodney, Process Equipment Div. 821
Jeffrey Mfg. Co. 201
Link Belt Co. 532
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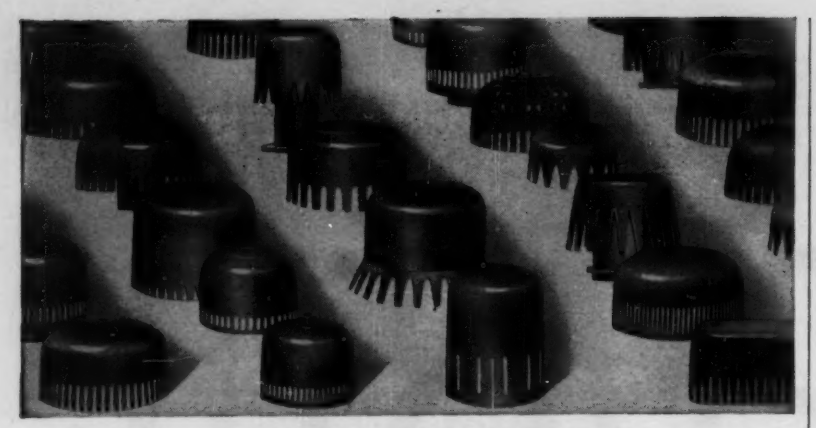

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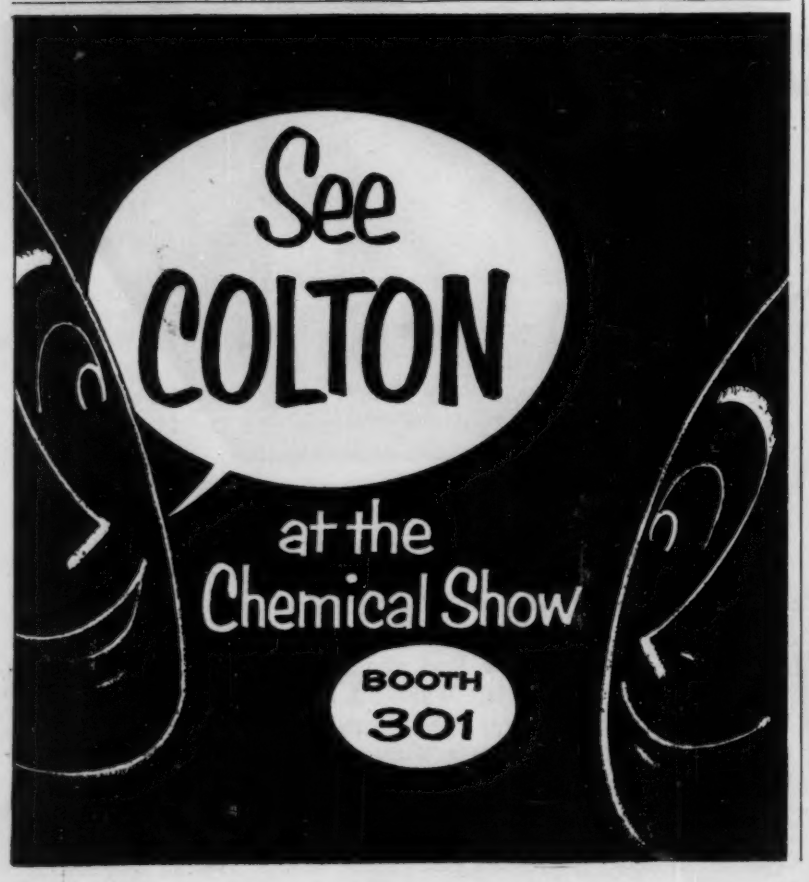

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Trent, Inc. 803
Whiting Corp. 932

DUST AND FUME COLLECTING SYSTEMS

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Colton Co., Arthur 301
Day Co., The 5
Dracco Corp. 808
Dust Suppression & Engineering Co. C-163
Dustex Corp. 413
Entoleter Div., The Safety Car Heating and Lighting Co. 703
General American Transportation Corp. 42-44
Heil Process Equipment Corp. 622-624
Knight, Maurice A. 7
Koppers Co., Metal Products Div., Precipitation Dept. 121-125
National Dust Collector Corp., Div. National Engineering Co. 232
Pangborn Corp. 906
Pulverizing Machinery Div., Metals Disintegrating Co. C-30
Schneible Co., Claude B. 900
Shutz-O'Neill Co. 418
Sly Manufacturing Co., The W. W. 43
Sprout, Waldron & Co., Inc. 109-111-113
Standard Steel Corp. 801
Westinghouse Electric Corp. 60
Wheelabrator Corp. 133

DUST AND SPRAY MASKS

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Pangborn Corp. 906

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Falls Industries, Inc. 37
Haveg Corp. 534
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Ingersoll-Rand Co. 918
Penberthy Injector Co., Div. of Buffalo Eclipse Corp. 426

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New York Laboratory Supply Co., Inc. C-41
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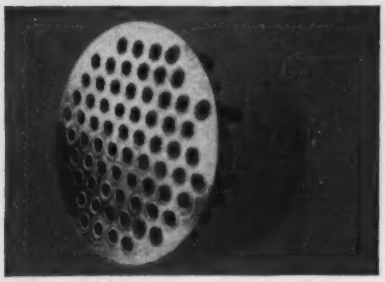

HIGH-VELOCITY STEAM and biting hydrochloric acid were cutting the service life of cast-iron steam diffusers to less than 3 months at a Du Pont Pigments plant. Bronze and corrosion-resistant alloys were tried, without improvement. Then a diffuser fabricated from titanium was installed. This proved to be the answer. The photo shows the condition of the titanium diffuser after 2 years' service—a period ten times the average life of other diffusers. Compare the uncorroded appearance of the titanium diffuser with the cast-iron flange, which shows severe acid attack.

A partial list of other environments where TITANIUM offers unmatched corrosion resistance . . .

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Sodium Chloride	All Conc. at 100° C.	Kettles, heat exchangers
Chlorine-Saturated Water	Room Temperature	Proportioning equipment
Wet Chlorine Gas	75° C.	Recovery equipment, electrolytic cells
Chromic Acid	10% and boiling	Plating equipment
Sulphuric-Nitric Acid Mixture	40% sulphuric, 60% nitric at 35° C.	Acid heaters, nitrators, auxiliaries
Calcium Hypochlorite	6%-35° C.	Filter presses, processing equipment
Zinc Chloride	20%-100° C.	Coils, pans, evaporators

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If you're looking for a way to improve your product . . . or cut production and maintenance costs by extending the service life of essential equipment . . . it may pay you to investigate titanium. As a pioneer *supplier* of titanium sponge, Du Pont has the experience to offer you expert technical help with your evaluation tests . . . can put you in touch with manufacturers best equipped to work with you on your particular product or application. Considerable fabricating know-how and a wide variety of mill shapes are available now to help you use titanium to solve your corrosion problems. For more detailed information on titanium, just check the coupon below, or write: E. I. du Pont de Nemours & Co. (Inc.), Pigments Department, Wilmington 98, Delaware.

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Nichols Engineering & Research Corp. 631
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Southwestern Engineering Co. C-56, C-58
Sprout, Waldron & Co., Inc. 109-111-113

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Falls Industries, Inc. 37
General Ceramics Corp. 37
Haveg Corp. 534
Hunt Machine Co., Rodney, Process Equipment Div. 821
Knapp Mills, Inc. and Andrews-Knapp Construction Co. 19
Koven & Brother, Inc., L. O. 834
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Platecoil Div. Tranter Mfg., Inc. 340-342-344
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Wallace & Tiernan Inc. 6
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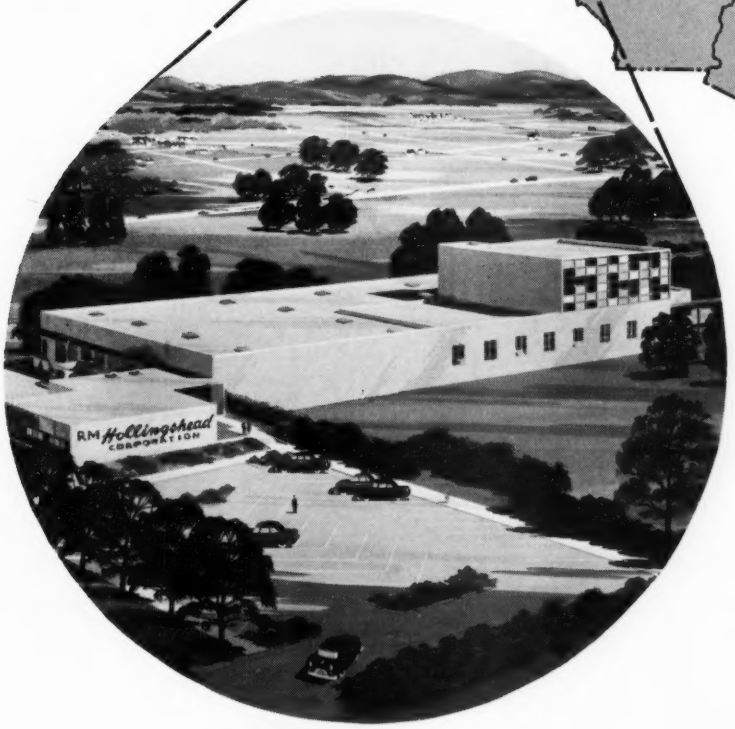

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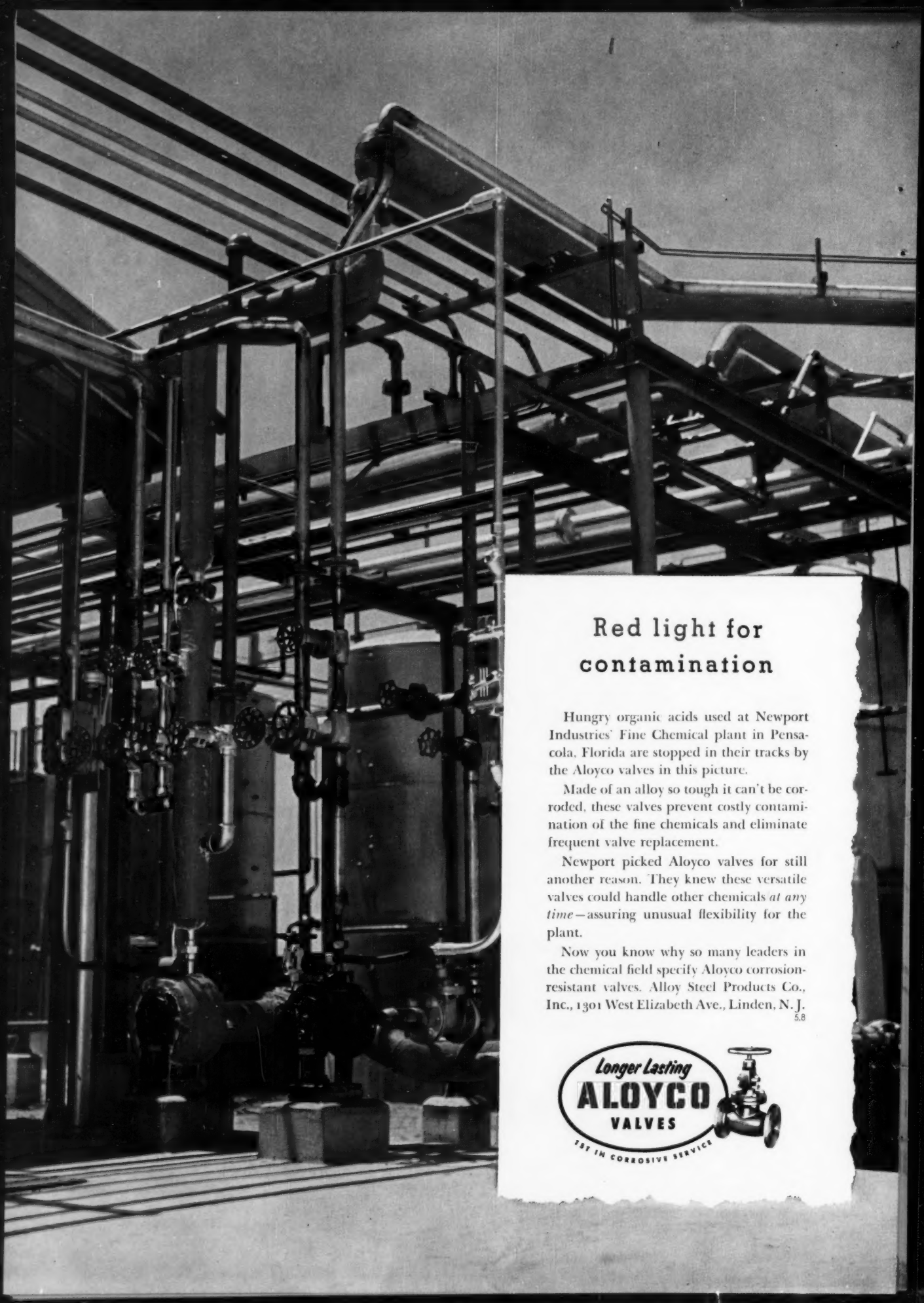

Red light for contamination

Hungry organic acids used at Newport Industries' Fine Chemical plant in Pensacola, Florida are stopped in their tracks by the Aloyco valves in this picture.

Made of an alloy so tough it can't be corroded, these valves prevent costly contamination of the fine chemicals and eliminate frequent valve replacement.

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5.8

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Tolhurst Centrifugals Div., American Machine & Metals Inc. 802-806
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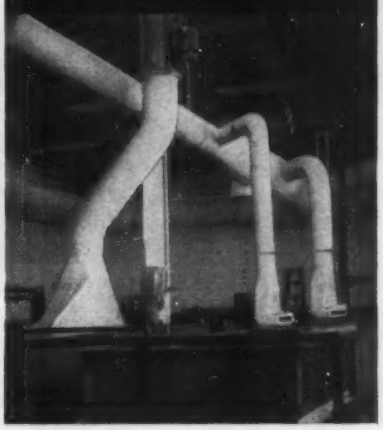

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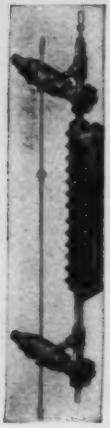
No. 25-R-20 gage, side connected with No. 66 valves (offset inside)

Large Chamber Gage, Reflex Type

Welding Pad Gages, staggered for continuous visibility

GA Instrument Piping Valve saves connections

No. 93 Valve (Jacketed for Heating or Cooling)



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Scientific Glass Apparatus Co....54

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Machlett & Son, E....C-33
National Filter Media Corp., The....616
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Sharples Corp., The C-29
Sparkler Mfg. Co. C-54
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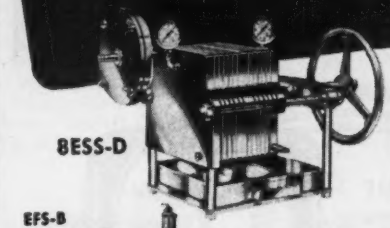

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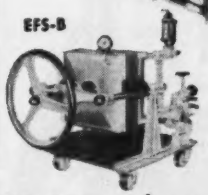

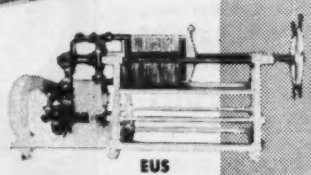

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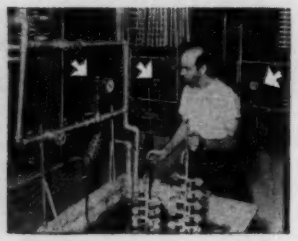

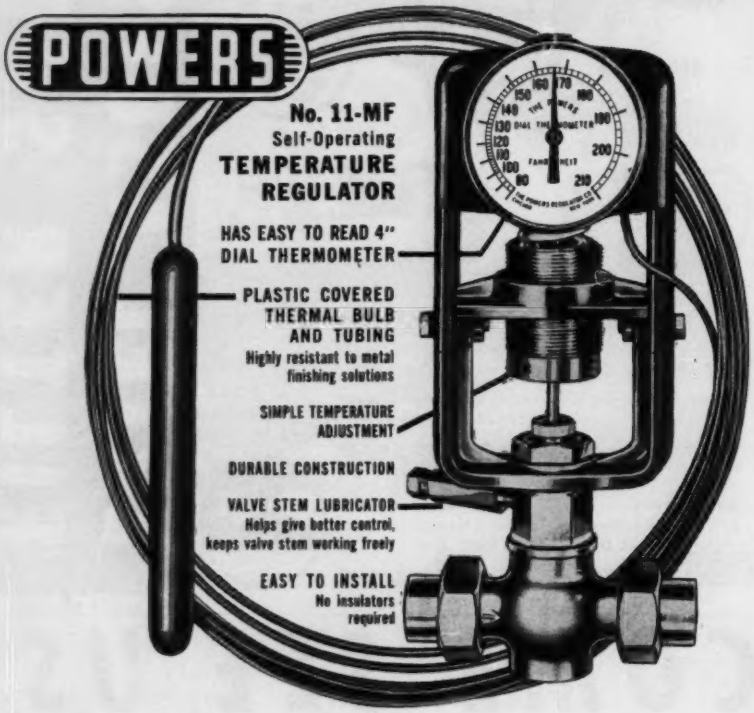

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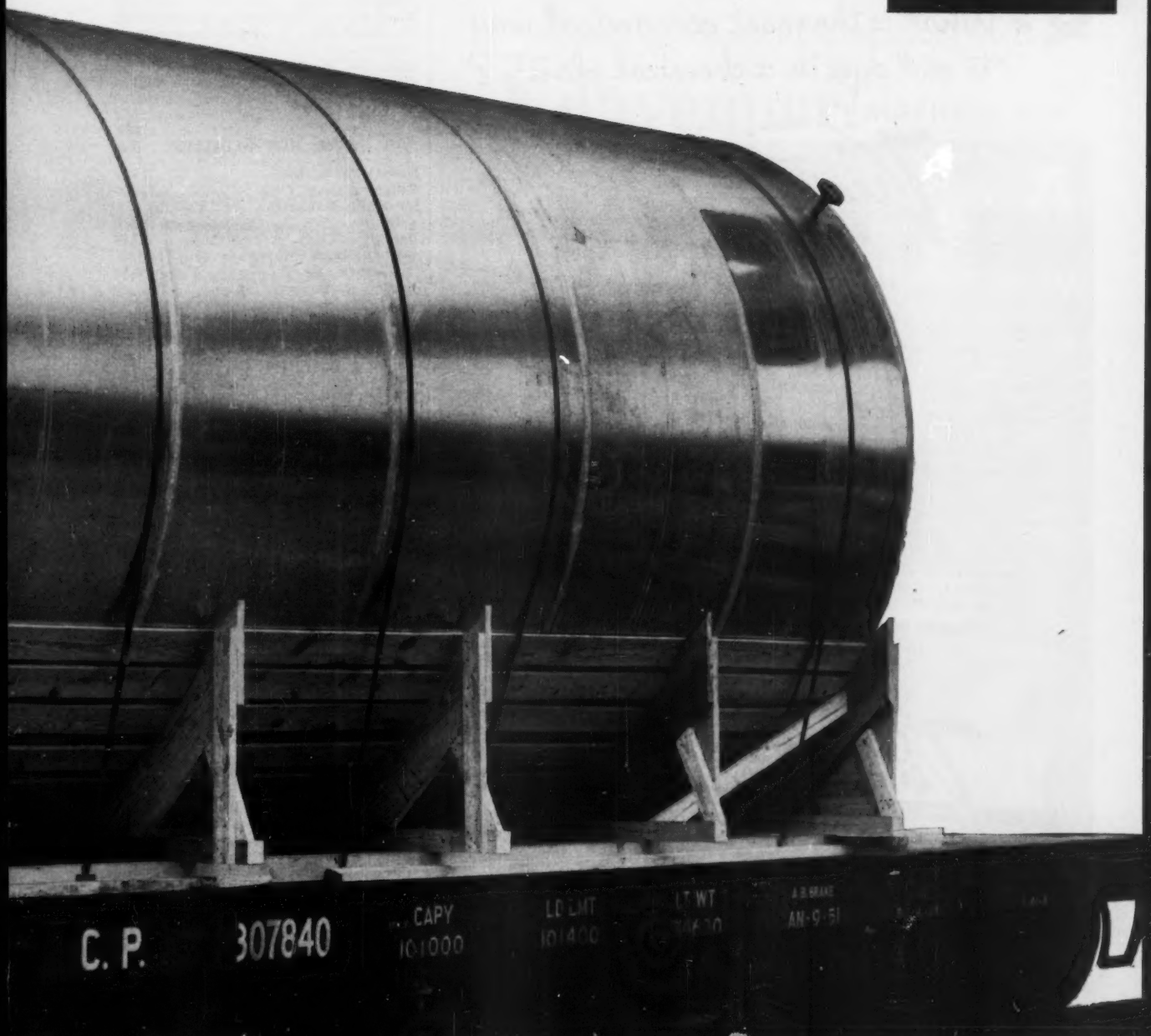
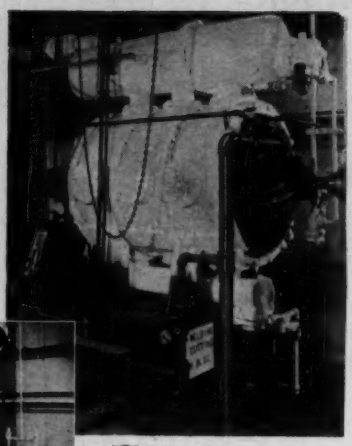
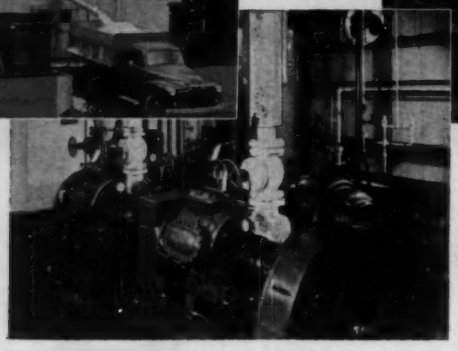


The photos below were taken at the Hilton-Davis Chemical Company of Cincinnati, Ohio, a well known producer of dyestuffs for the textile industry.

A truck at Hilton-Davis loads up with Pakice Briquettes stored in an 80-ton storage bin.



One of the two 30-ton horizontal Pakicers installed at Hilton-Davis.



Two of the Vilter VMC's which provide the refrigeration for the two 30-ton Pakicers.

Q. *What is the most economical way to cool dyes in a chemical plant?*

A. use **Vilter REFRIGERATION** that

costs less to own*

In the production of dyestuffs, much unwanted heat is generated. One of the most practical methods for removing this heat is to use ice, both directly and in latent heat storage. For many years the Hilton-Davis Chemical Company purchased large quantities of expensive block ice for this job. Then Vilter field personnel proved the superiority of freezing and using Vilter Pakice Briquettes.

With Vilter Pakice equipment in the chemical as well as other industries, you can manufacture your own ice and save as much as 50% over other methods. In cases other than solution cooling, where air or product cooling is desirable or necessary, Pakice Briquettes also find favor. These hard, cold Briquettes, scientifically designed for minimum contact, pack closely, yet allow free passage of air over their surface. Actual tests prove that Pakice Briquettes cool to lower temperatures faster.

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* Savings in low first cost are not the complete answer when considering the installation of refrigeration equipment. But savings in terms of years of extra service, reliable performance and minimum maintenance—that's where Vilter excels in low-cost ownership.

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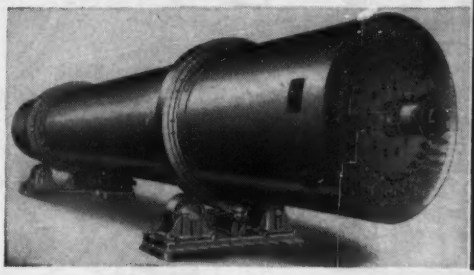

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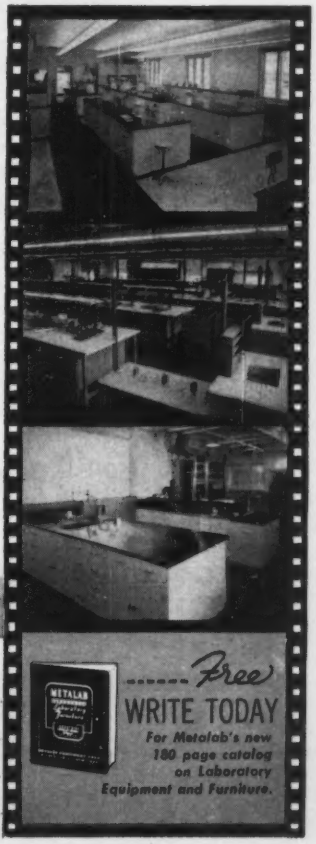

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SEALOL

THE BALANCED PRESSURE SEAL

Sauereisen Cements Co. S-26
United States Gasket Co. 740
Westinghouse Electric Corp. 60

INSULATION, FURNACE

Amersil Co., Inc. C-17, C-19, C-21
Dicalite Div., Great Lakes Carbon Corp. 306-308
Johns-Manville Sales Corp. 508

JOINTS

Ace Glass Inc. 710
Barco Mfg. Co. C-20
Chiksan Co. 607
Croll-Reynolds Engineering Co. 234
Doré Co., John L. C-139
Emsco Mfg. Co. C123, C127
Johns-Manville Sales Corp. 508
Lovejoy Flexible Coupling Co. 448
Resistoflex Corp. 248
Rothern Mfg. Co. C-143
Spraying Systems Co. 833
United States Gasket Co. 740
Yarnall-Waring Co. 633

KETTLES

Allis-Chalmers Mfg. Co. 934
Blaw-Knox Co. 103
Blickman, Inc. 407
Cleveland Mixer Co., The 825
Downington Iron Works, Inc., Div. of Pressed Steel Tank Co. 714
General Ceramics Corp. 37
International Engineering, Inc. C-114
Knight, Maurice A. 7
Koven & Brother, Inc., L. O. 834
Lehmann Company, Inc., J. M. C-43
Misco Fabricators, Inc. 723
New England Tank & Tower Co. 52
Patterson Foundry & Machine Co. 331
Patterson-Kelley Co., The 739-831
Pfaudler Co., The 502
Star Tank & Filter Corp. 129
Terriss Div., Consolidated Siphon Supply Co. 244
Thermo-Panel Div., Dean Products, Inc. 744
Trent, Inc. 803
United States Stoneware Co., The 10-12-14

KILNS

Allis-Chalmers Mfg. Co. 934
American Gas Furnace Co. 638
Bartlett & Snow Co., The C. O. 247
Blaw-Knox Co. 103
Davenport Machine & Foundry Co. C-39
Electric Hotpack Co., The 933
General American Transportation Corp. 42-44
Hardinge Company, Inc. 4
Pfaudler Co. 502
Standard Steel Corp. 801

LABELING MACHINES

Pharmaceutical and Chemical Industry Supply Corp. C-55
Pneumatic Scale Corp., Ltd. 77

LABORATORIES, TESTING

American Instrument Co. 736
Laboratory Equipment Corp. C-124
Nichols Engineering & Research Corp. 631
Podbielniak, Inc. 601

LABORATORY APPARATUS & SUPPLIES

Ace Glass Inc. 710
American Agile Corp. 817
American Instrument Co. 736
American Plant Equipment Co. S-65
Amersil Co., Inc.....C-17, C-19, C-21
Autoclave Engineers Sales Corp. ...434
Baker & Co. C-17, C-19, C-21
Baker Perkins, Inc. 540-544
Barnstead Still & Sterlizer Co. 636
Bartlett & Snow Co., The C. O. 247
Bethlehem Apparatus Co. C-148
Bishop & Co., J., Platinum Works...809
Brinkman & Co., C. A. C-36
Brookfield Engineering Laboratories, Inc. 424
Carver, Inc., Fred S. 8
Centrico, Inc. 731
Chemineer, Inc. C-155
Corning Glass Works 25-27
Derrick Manufacturing Co. C-28
Ertel Engineering Corp. 614
Electric Hotpack Co., The 933
Fischer & Porter Co.....200-202
Great Western Mfg. Co....741-743
Hanovia Chemical & Mfg. Co. C-17, C-19, C-21
Hardinge Co. 4
High Pressure Equipment Co. 717
International Engineering Inc. C-114
Kimble Glass Co. 408
Kinetic Dispersion Corp. C-118
Kontes Glass Co. C-154
Laboratory Glass Supply Co. C-135
Laboratory Equipment Corp. C-124
Luzerne Rubber Co. 409
Machlett & Son, E,....C-33
Martinson Machine Co....C-136
Minneapolis-Honeywell Regulator Co., Industrial Div....531
Mixing Equipment Co. 800
Morehouse-Cowles, Inc. C-22
New Brunswick Scientific Co. 626
New York Laboratory Supply Co. ..C-41
Photovolt Corp....635
Podbielniak, Inc. 601
Precision Scientific Co. 67
Research Controls C-134
Scientific Glass Apparatus Co. 54
Selas Corp. of America 62
Sturtevant Mill Co.....905
Technican Co., The C-32
Terriss Div., Consolidated Siphon Supply Co. 244
Thomas Co., Arthur H. 16
Tri-Home Corp. 305
Tyler Co., The W. C. 46
United States Stoneware Co., The 10-12-14
Welch Mfg. Co., W. M. C-42

LABORATORY FURNITURE

Alberene Stone Corp. of irginia 533
Duralab Equipment Corp. C-57
Durock Corp. C-153
Hamilton Mfg. Co. C-161
Kewaunee Mfg. Co. 707
Laboratory Furniture Co. 414
Metalab Equipment Co., Div of Norbute Corp....901
New York Laboratory Supply Co...C-41
Scientific Glass Apparatus Co. 54
Sheldon Equipment Co., E. H. 136
Welch Mfg. Co., W. M. C-42

LAMPS

Hanovia Chemical and Mfg. Co. C-17, C-19, C-21

LEAD BURNING AND COATING

General Lead Construction Corp. ...C-27
Heil Process Equipment Corp....622-624

NEW *The Continuous Flow* **"EPPENBACH" HOMO-MIXER**

Specializing in the Processing of **POLYURETHANE MATERIALS**

EXCLUSIVE FEATURES

1. Adapted to stationary or portable operation.
2. Can be vertically or horizontally mounted.
3. Speed regulation controls discharge capacity.
4. Homogenizing head quickly dismantled for cleaning.
5. Can be modified to suit any existing processing requirement.
6. This Continuous Flow Homo-Mixer can be easily converted to our Standard high speed, high gear unit for producing emulsions and dispersions of small particle size, (as described in Catalog #402-R-1)

Made in both Laboratory and Production models so Laboratory or Pilot scale results can be reproduced on a production basis.

ADMIRAL TOOL & MFG. CO. INC. • QUALITY •

For additional information refer to Model #3000CF

How it Operates

Isocyanate and resin along with other modifiers are introduced, via a suitable metering and proportioning apparatus, into the homogenizing zone of the turbine mixer where they are uniformly blended and then discharged under pressure.

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Low Cost Contamination Control

chlorinated organics
phenol
hot caustic liquors
caustic potash
alcohols
caustic soda
natural gas
glycerine
formaldehyde

LECTRO-CLAD

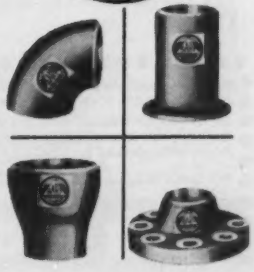
NICKEL-PLATED SEAMLESS

Pipes - Tubings - Fittings

Uniform, pore free nickel deposit fully adherent to the steel pipe.

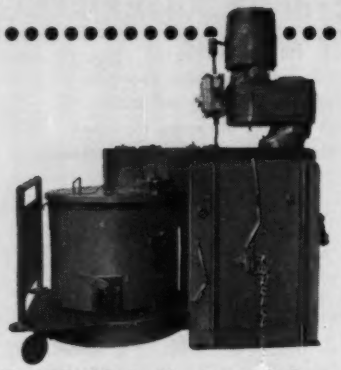
The exclusive time-tested BART LECTRO-CLAD PROCESS electrolytically deposits a corrosion resistant nickel lining on the interior surface of steel pipe from 1½" to 24" diameter and in 20-foot random lengths.

LECTRO-CLAD is the answer to corrosion and contamination problems in the conveying of highly corrosive materials . . . and the cost is surprisingly modest.



BART MANUFACTURING CORP.
229 Main Street Belleville 9, New Jersey
Visit our Booth S107 at Chemical Show

Now! A Change Can Mixer with Performance Advantages of a Heavy Duty Paste Mixer!



The "Pony" Paste Mixer comes in 2 convenient types: TYPE 1—With portable turntable *(shown)*. **TYPE 2**—With attached turntable.

Unique mixing action! There you have the "secret" of the "Pony" Paste Mixer. This machine combines the mixing advantages of the sigma blade, or heavy duty, paste mixer with the versatility and ease of cleaning of a change can mixer. Here is how it works:

The "Pony" Mixer's 2 sets of U-shaped blades approach its two stationary breaker bars at a constantly diminishing angle, compressing the materials caught between. This creates intense shear and excellent wetting.

Close-up of the "Pony" Paste Mixer's U-shaped polished steel blades.

The staggered position of the blades permits these intense actions to be in rapid series. This reduces the load on the machine and permits the handling of heavy pastes with comparatively little power requirements.

The wide tapered bottom blades impart an upward thrust and rolling action to the material. The can rotates in the same direction as the mixing blades at an unsynchronized rate of speed. The entire batch is constantly agitated, constantly moving; "dead" spots and stratification of materials are eliminated. This, plus the intense shear developed, guarantees superior wetting, a homogeneous batch and reduces the load in any subsequent dispersing process.

Find out how the "Pony" Mixer can help *your* production. For a free, illustrated folder, fill in and mail the coupon *today!*

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GENTLEMEN: Please send me your free, illustrated folder describing the "Pony" Paste Mixer in complete detail.

*My name is*_____

*Company*_____

*Address*_____

*City*_____ *Zone*____ *State*_____

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Knapp Mills Inc. & Andrews-Knapp Construction Co. 19
Lead Lined Iron Pipe Co. 210
Treadwell Construction Co. 729
United States Stoneware Co., The 10-12-14
Wall-Derkiss, Inc. 339

LIME, CHEMICAL & HYDRATED

Minerals & Chemicals Corp of America 807

LOADERS

Eimco Corp., The C-9
General American Transportation Corp. 42-44
Hough Co., The Frank G. 69
Link Belt Co. 532
Sprout, Waldron & Co., Inc. 233-235

LUBRICATING SYSTEMS

Farval Corp. 72

MAGNETIC SEPARATORS

Cesco S-68
Eriez Mfg. Co. C-157
Exolon Co. 609
Jeffrey Mfg. Co., The 201
Magnetic Engineering and Mfg. Co. ..236
Prater Pulverizer Co. 336-338
Terriss Div., Consolidated Siphon Supply Co. 244

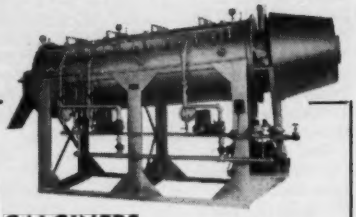
MASTICATORS

Miller & Son, Inc., Franklin P., Supreme Crusher Div. C-31
Rietz Mfg. Co. 719-721
Ross & Son Co., Charles 447

MATERIALS HANDLING EQUIPMENT

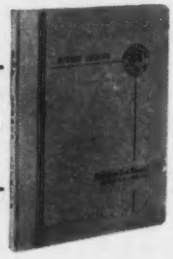
Allis-Chalmers Mfg. Co. 934
BIF Industries, Inc. 902
Barrett-Cravens Co. .....634 & 733
Bartlett & Snow Co., The C. O. 247
Beaumont Birch Co. 445
Buda Div., Allis-Chalmers Mfg. Co. ..934
Carrier Conveyor Corp. 117
Chain Belt Co. 432
Day Co., The J. H. 921-925
Dracco Corp. 808
Eimco Corp., The C-9
Eriez Mfg. Co. C-157
General American Transportation Corp. 42-44
Great Western Mfg. Co. 741-743
Gump Co., B. F. 23
Hewitt-Robins Inc. C-14
Hough Co., The Frank G. 69
Jeffrey Mfg. Co., The 201
Link Belt Co. 532
Luzerne Rubber Co., The 409
Magnetic Engineering and Mfg. Co. . 236
Mission Mfg. Co., Centrifugal Pump Div. C-147
Pulva Corp. 330
Pulverizing Machinery Div., Metals Disintergrating Co. C-30
Read Standard Corp. 608
Simpson Mix-Muller Div., National Engineering Co. 232
Sprout, Waldron & Co., Inc. ..109-111-113
Tote Systems, Inc. 605
United States Stoneware Co., The 10-12-14

AGF Industrial Heating Appliances

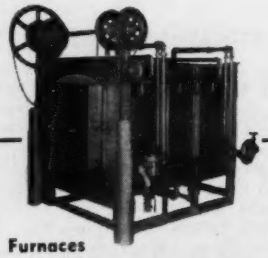


CALCINERS
Rotary Retort Calciners—Continuous and Batch Type. Retort sizes up to 24" dia. by 15' long. Described in Catalog 606C.

BURNERS
New Burner Catalog C6A gives complete technical data on air-gas and oxygen-gas burner equipment.



- Sharp Flame Ribbon Burners
- Fishtail Burners
- Needle Point Glass Fires
- Blowpipes
- Hand Torches
- Mixing Equipment
- Flow Meters
- Fire Checks
- Ball Joints
- Blast Burners
- Oxygen-Hydrogen Burners
- Furnace Burners



- Furnaces

Oven Furnaces for operation up to 2500° F. Bulletin 215 details construction and sizes available.

Visit AGF at the Chemical Show - Booth 638

AMERICAN GAS FURNACE CO.
"Pioneers since 1878"

. . . no other filtering medium compares with

ANTHRAFILT

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Years of efficient and economical use in every type of filter plant has made Anthrafilt the standard of excellence in the filtering medium field.

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ANTHRAFILT provides greater capacity . . . longer filter runs . . . cleaner washings at lower cost . . . removes entrained turbidity from industrial process solutions or wastes.

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Representing
ANTHRACITE EQUIPMENT CORP.
Anthracite Institute Bldg., Wilkes-Barre, Pa.

METAL COATING AND PLATING

Armco Steel Corp. 231
Bart Mfg. Corp. S-107
General American Transportation Corp. 42-44
M. W. Protective Coatings Div., Metalweld, Inc. 240
Quelcor, Inc. 348
Stokes Machine Co., F. J. 910
Treadwell Construction Co. 729

METAL CONTAINERS

Delaware Barrel & Drum Co. C-25
Greif Bros. Cooperage Corp., The 76
Heil Process Equipment Corp. 622-624
Misco Fabricators, Inc. 723
Murray Co., A. B. S-32
National Lead Co. 702-706-708
Pressed Steel Tank Co. 714
Reynolds Metals Co. 436
Tote Systems, Inc. 605

METALS

Aluminum Co. of America 233-235
Allegheny Ludlum Steel Corp. 28
American Platinum Works, The C-17, C-19, C-21
Ampco Metal, Inc. 913
Armco Steel Corp. 231
Baker & Co. C-17, C-19, C-21
Bethlehem Apparatus Co. C-148
Bishop & Co., J., Platinum Works 809
Callery Chemical Co. C-59
Carborundum Metal Co., Inc., The Div. of The Carborundum Co. 347
Cooper Alloy Corp. 602
Duriron Co., The 59
Eastern Stainless Steel Corp. 126
General Alloys Co. 748
Haynes Stellite Co., Div. of Union Carbide & Carbon Corp. 350
Industrial Steels, Inc. 726
International Nickel Co., The 507
Lukens Steel Co. 66
Murray Co., A. B. S-32
National Lead Co. 702-706-708
Rem-Cru Titanium, Inc 433
Republic Steel Corp. 535-539
Sel-Rex Precious Metals, Inc. S-107
Titanium Alloy Mfg. Div., National Lead Co. 708
United States Steel Corp 518-522
Westinghouse Electric Corp. 60
Whitehead Metal Products Co. 429

METERS

American Gas Furnace Co. 638
BIF Industries, Inc. 902
Bailey Meter Co. 30
Beckman Instruments, Inc. 643
Brooks Rotameter Co. 606
Buffalo Meter Co. 442
Control Engineering Corp. 118-122
Fischer & Porter Co. 200-202
Foxboro Co., The 139
Heyl & Patterson, Inc. 226
Hoke Inc. 935
Jacoby-Tarbox Corp. 632
Minneapolis-Honeywell Regulator Co., Industrial Div. 531
Philadelphia Pump & Machinery Co. C-130
Photovolt Corp. 635
Potter Aeronautical Co. C-40
Precision Scientific 608
Quaker Oats Co., The Electrostatic Div. of Mechanical Research Dept. 15
Welch Mfg. Co., W. M. C-42
Westinghouse Electric Corp. 60

(Continued on p. 352)

for PUMPING CHEMICAL SOLUTIONS!

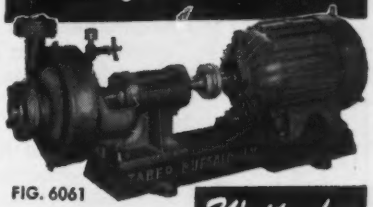


FIG. 6061

Write for

TABER BULLETINS C-355 *for* **HORIZONTAL PUMPS** *for* **VERTICAL PUMPS V-837**

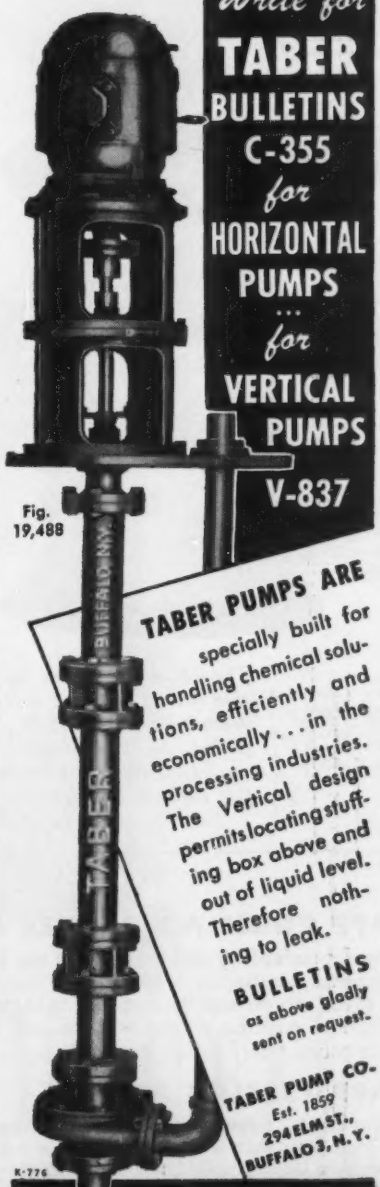


Fig. 19,488

TABER PUMPS ARE specially built for handling chemical solutions, efficiently and economically . . . in the processing industries. The Vertical design permits locating stuffing box above and out of liquid level. Therefore nothing to leak.

BULLETINS as above gladly sent on request.

TABER PUMP CO.
Est. 1859
294 ELM ST.,
BUFFALO 3, N. Y.

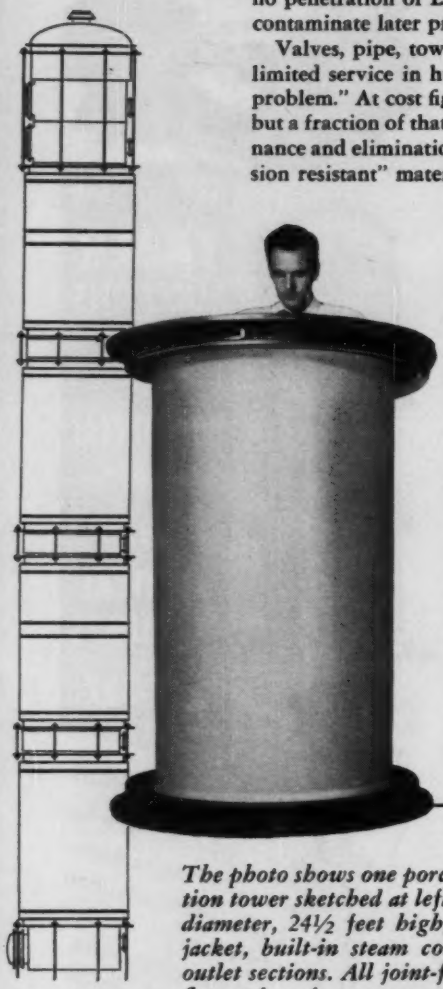
K-776

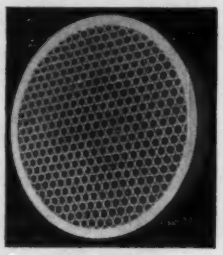
TABER

Lapp CHEMICAL PORCELAIN

Chemical inertness to acids of all concentrations is a characteristic of porcelain. And, as made by Lapp, it is pure, dense, hard, close-grained, homogeneous and *non-porous*. This means there can be no penetration of Lapp Porcelain—no crumbling from capillary pressures—no absorption of liquids to contaminate later processing.

Valves, pipe, towers, and special shapes of Lapp Chemical Porcelain are operating with almost unlimited service in hundreds of installations where "no other material would ever handle the corrosion problem." At cost figures that set records for economy, too. For Lapp Chemical Porcelain equipment costs but a fraction of that for special alloy and lined equipment—and quickly makes up, in reduced maintenance and elimination of need for replacement, the difference in its initial cost over that of cheaper "corrosion resistant" materials.





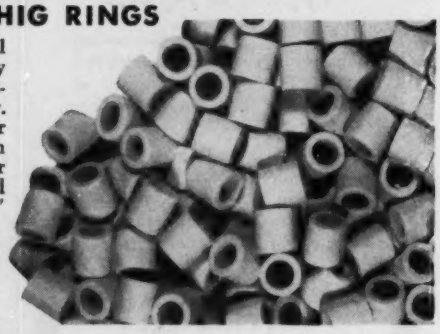
LAPP PORCELAIN CHEMICAL TOWERS AND TOWER PLATES

For distillation, absorption, fractionation... or any process where liquids and gases must be tower-processed—towers of Lapp Porcelain assure long life, non-corrosion and purity of output. These towers are made entirely of porcelain (except for externally attached hardware, armor, steam-heat piping, jacketing, etc.). They can, on specification, be supplied with polished optically-flat joint faces for assembly without gaskets.

The Lapp Porcelain ring support plate is built of contiguous thin-walled glazed porcelain tubes, permanently compressed and fused in a heavy outside porcelain ring. It provides almost twice as much free space as conventional drilled or slotted plates.

LAPP PORCELAIN RASCHIG RINGS

Lapp Raschig Rings are of solid Chemical Porcelain, completely vitrified, strictly non-porous and iron-free. Inert chemically, they offer an indefinite life chemically. Physically, Lapp Porcelain is tougher against the abuse of tower operation than most of the regularly used tower packings. "Standard" rings ⅜" to 3" and heavy-duty partition rings 3" and 4" available from stock.



The photo shows one porcelain section of the Lapp absorption tower sketched at left. This tower, 26 inches in inside diameter, 24½ feet high, is provided with an insulated jacket, built-in steam coils, Tufclad-armored dome and outlet sections. All joint-faces are polished to an optically flat surface for vacuum tight assembly without gaskets.

LAPP PORCELAIN VALVES AND PIPE

The dependability and long life of the Lapp Valve, attested by successful installation in hundreds of chemical processes, is due to its sound design and the fact that it is made of *porcelain*—body, plug and packing rings. Y-valves and angle-valves ½" to 6", plug cocks, safety valves, flush valves, pipe and fittings ½" to 8".

LAPP TUFCLAD ARMOR

Security and safety of plant and personnel are assured with use of Lapp Porcelain with Tufclad armor—multiple layers of woven fiberglass impregnated and bonded to the porcelain with an Epoxide resin. Armor will hold operating pressures against gross leakage, even though porcelain body is damaged by impact, thermal shock, explosion or fire.

BOOTH 814 . . . Chemical Show

WRITE for description and specifications of Lapp Porcelain processing equipment. Lapp Insulator Co., Inc., 150 Wendell St., Le Roy, N. Y.

Lapp PULSAFEEDER

PISTON-DIAPHRAGM CONTROLLED-VOLUME PUMP

NO STUFFING BOX . . . NO LEAKAGE

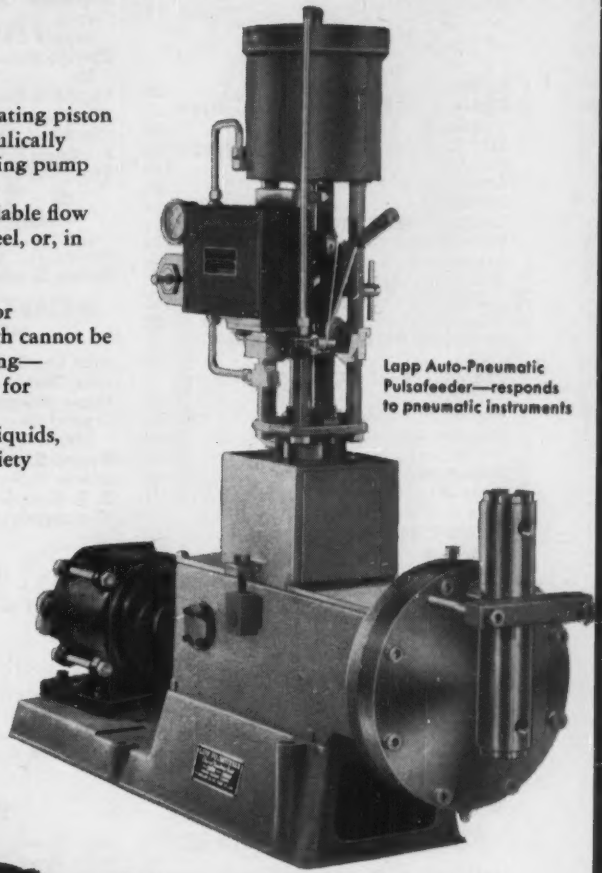
Basic feature of Lapp Pulsafeeder design is its combination of reciprocating piston action (to provide the accuracy of positive displacement) with a hydraulically balanced diaphragm which isolates material being pumped from working pump parts—and, of course, eliminates need for stuffing box or running seal.

Control of pumping rate is achieved at constant pumping speed; variable flow results from variation in piston stroke length—adjustable by hand-wheel, or, in Auto-Pneumatic models, by instrument air pressure responding to any instrument-measurable processing variable.

In general, use of the Lapp Pulsafeeder is indicated for continuous (or intermittent) pumping, at accurately controlled volume, of fluids which cannot be safely exposed to conventional pistons, cylinders and stuffing box packing—because of the corrosive action of chemicals being handled and/or need for protection of product against contamination.

To meet the varied demands of low-viscosity liquids, high-viscosity liquids, slurries and gases, liquid-handling heads and valves are offered in a variety of materials and designs.

WRITE for Lapp Bulletin 440 which shows typical Pulsafeeder applications and flow charts, and which describes and lists specifications of models over a wide range of capacities and constructions. Lapp Insulator Co., Inc., 150 Wendell St., Le Roy, New York.

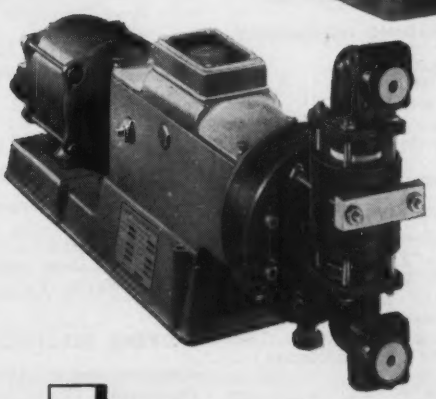


Lapp Auto-Pneumatic Pulsafeeder—responds to pneumatic instruments

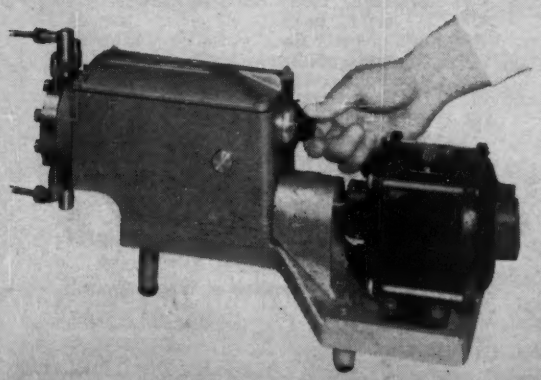
NEW "Microflo" Pulsafeeder

for precision pumping at micro flow rates

The "Microflo" Pulsafeeder brings the Pulsafeeder principle of controlled volume pumping to research applications, pilot plant and production line use which require precise pumping, metering of fluids, chemical feeding, sampling, proportioning and filling at micro flow rates. "Microflo" Pulsafeeder employs the same proportioning pump design features of the PULSAFEEDER—has no stuffing box, permits no leakage. Maximum flow of 2150 ML. per hour, at 1000 psig. Lapp "Microflo" Pulsafeeder assures years of dependably accurate pumping with no danger of pump failure, corrosion, contamination or leakage of liquid being pumped. *WRITE for Bulletin 500 which gives complete description and specifications for Lapp "Microflo" Pulsafeeder.*



Lapp Pulsafeeder with non-metallic liquid end, ball valves



Lapp PROCESS EQUIPMENT

MICROSCOPES

American Instrument Co. 736
Brinkman & Co., C. A. C-36
Machlett & Son, E. C-33
New York Laboratory Supply Co. ..C-41
Perkin-Elmer Corp., The 705
Scientific Glass Apparatus Co. 54
Thomas Co., Arthur H. 16
Welch Mfg. Co., W. N. C-42

MILLS

Chemicolloid Laboratories, Inc. 22
Combustion Engineering, Inc., Raymond Div. 68
Day Company, Inc., The J. H. ...921-925
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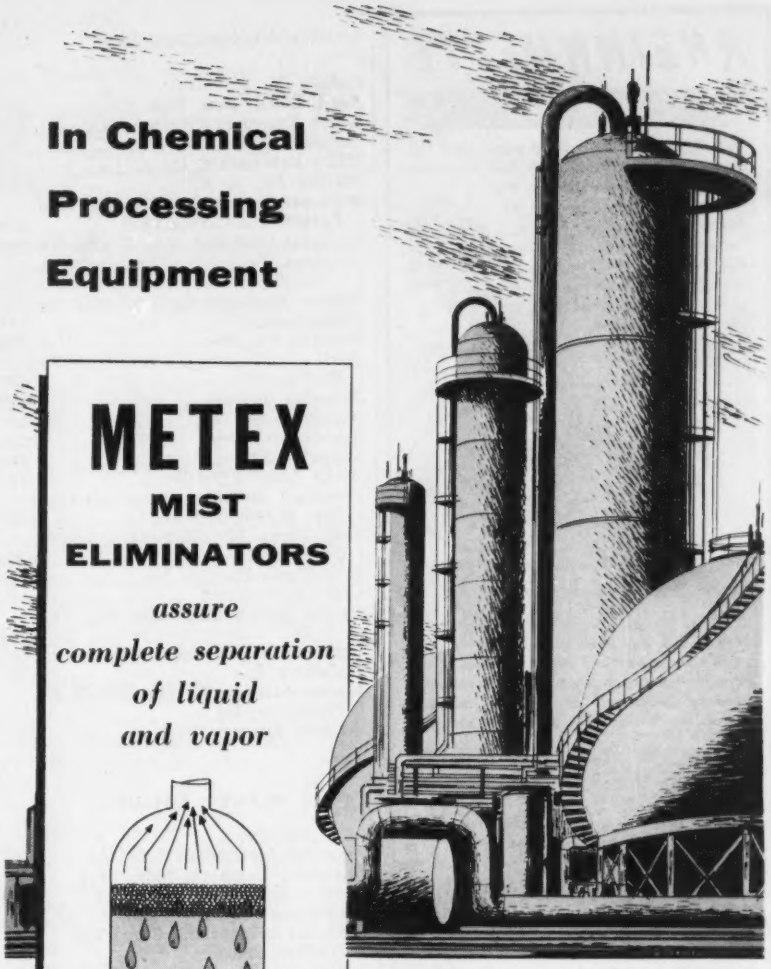

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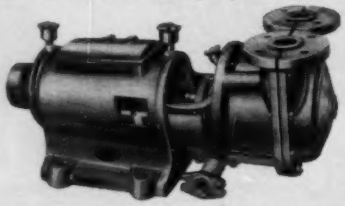

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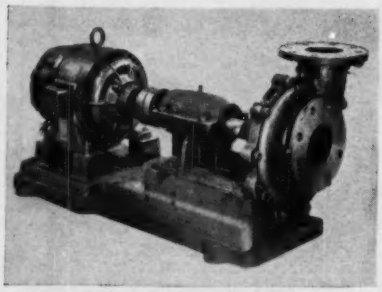

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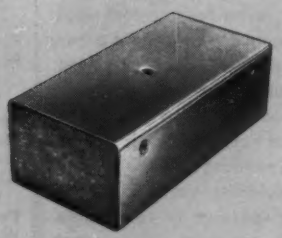

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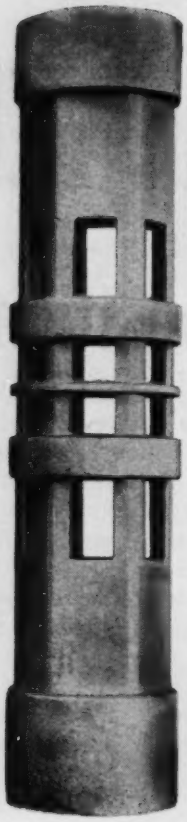

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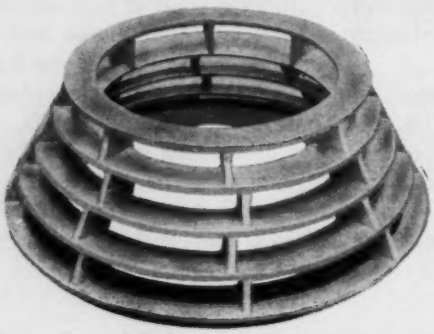

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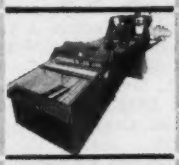
DENVER Steel-Head **BALL MILL**		3'x 2' to 6'x 12'	A Denver Steel-Head Ball Mill will suit your particular need. Five types of discharge trunnions. All-steel construction. Low initial cost due to quantity production. Quick delivery. Laboratory and pilot plant mills also available. Please write for Bulletin No. B2-B13.
DENVER CLASSIFERS		18" to 60" Wide Suitable Length	Denver Rake Type Classifiers are available in sizes from 1'-6" x 14'-8" to 8' x 21'-8". Denver Spiral Classifiers range in size from 6" x 5'-8" to 60" x 33'-4". Denver Hydro Classifiers are available in diameters from 6' to 55'. All are designed to efficiently separate fine particles in specific applications. Please write for bulletin No. C5C-B.
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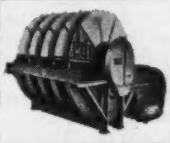
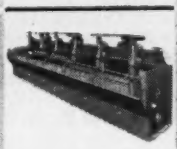
DENVER Disc **FILTER**		1 Disc, 2' to 8 Disc, 6'	Special, patented design of segments in Denver Disc Filters use both gravity and vacuum to give a drier filter cake. Drainage is complete and positive, with no blow-back. Simple, low-cost, dependable construction. Quick delivery. Also Drum and Pan Filters. Please write for Bulletin No. F9-B2.
DENVER "Sub-A" **FLOTATION**		Laboratory and Commercial	Flotation is the selective separation of particles from each other in a liquid pulp by means of air bubbles. More large plants are installing Denver "Sub-A's" for their entire flotation job, because they give maximum recovery at a low cost per ton. Dependable, low-cost, simplified continuous operation. Please write for Bulletin No. F10-B8T.
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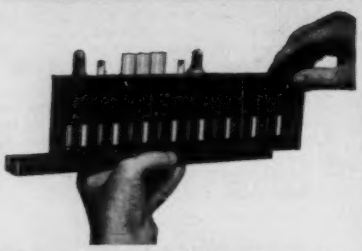

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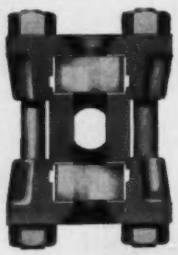

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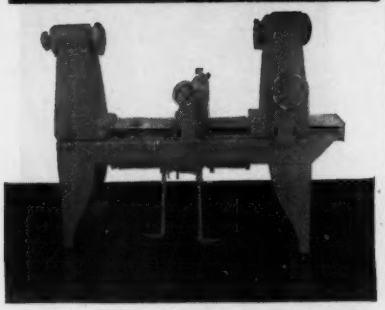

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Podbielniak, Inc.....601
Precision Scientific Co.....67
Stokes Machine Co., F. J.....910
Treadwell Construction Co.....729
Walker-Wallace Div., A. P. V. Co....543

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General Electric Co., Apparatus Sales Div. 850
Jarrell-Ash Co.....C-164
Machlett & Son, E.....C-33
Perkin-Elmer Corp., The.....705
Scientific Glass Apparatus Co.....54
Thomas Co., Arthur H.....16
Welch Mfg. Co., W. M.....C-42

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Bogue Electric Mfg. Co.....421
Cleveland Worm & Gear Co.....72
Link Belt Co.....532
Philadelphia Gear Works, Inc.....33
U. S. Electrical Motors, Inc.....148
Westinghouse Electric Corp.....60

STAIR STEPS, SAFETY

Black, Sivalls & Bryson, Inc.....114
Grip-Strut Div., The Globe Co...735-737

STEEL GRATING AND FLOORING

Grip-Strut Div., The Globe Co...735-737
Industrial Steels, Inc.....726

STERILIZERS

Aetna Scientific Co.....221
American Instrument Co.....736
Barnstead Still & Sterilizer Co.....636
Blaw-Knox Co.....103
Catalytic Combustion Corp.....C-133
Electric Hotpack Co., The.....933

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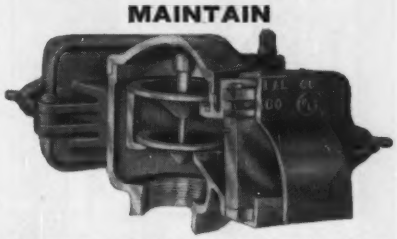

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Vertical position of arrester permits condensate to drain off freely—prevents frequent "clog-ups" and prolongs operating time.

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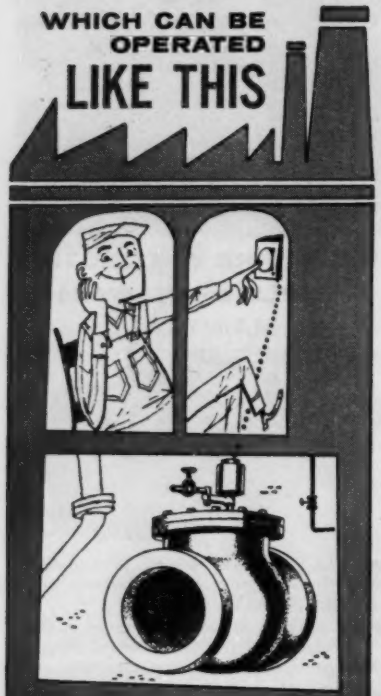

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✓ Positive Control

✓ Sizes ½" thru 36"

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Precision Scientific Co. 67
Wallace & Tiernan Inc. 6

STILLS

Aetna Scientific Co. 221
American Instrument Co. 736
Artisan Metal Products, Inc. 318
Barnstead Still and Sterilizer Co. 636
Blaw-Knox Co. 103
Blickman, Inc., S. 407
Electric Hotpack Co. 933
General Ceramics Corp. 37
Haveg Corp. 534
Hunt Machine Co. 821
Machlett & Son, E. C-33
Koven & Brother, Inc., L. O. 834
New York Laboratory Supply Co. . . C-41
Perry Products Co. 437
Precision Scientific Co. 67
Pfaudler Co., The 502
Selas Corp. of America 62
Star Tank & Filter Corp. 129
Stokes Machine Co., F. J. 910
Treadwell Construction Co. 729

STRAINERS
(See also Screens, Sieves, Separators)

Cuno Engineering Corp. 239
Foster Engineering Co. 208
Newark Monarch Mfg. Works, Inc. . . 701
Sarco Co. C-128
Spraying Systems Co. 833
Terriss Div., Consolidated Siphon Supply Co. 244
Yarnall-Waring Co. 633

SWITCHES

Automatic Switch Co. 646
Machlett & Son, E. C-33
Mineapolis-Honeywell Regulator Co., Industrial Div. 531
Westinghouse Electric Corp. 60

TACHOMETERS

Bailey Meter Co. 30
Potter Aeronautical Co. C-40

TANKS

Alsop Engineering Corp. 110
American Agile Corp. 817
Black. Sivalls & Bryson, Inc. 114
Blaw-Knox Co. 103
Blickman, Inc., S. 407
Chemineer, Inc. C-155
Colton Co., Arthur 301
Day Co., The 5
Delaware Barrel & Drum Co. C-25
Downington Iron Works, Inc., Div. Pressed Steel Tank Co. 714
General Alloys Co. 748
General American Transportation Corp. 42-44
General Ceramics Corp. 37
General Lead Construction Corp. . . . C-27
Glascote Products, Inc., Subsidiary of A. O. Smith 106
Haveg Corp. 534
Heil Process Equipment Corp. . . . 622-624
Hunt Machine Co. 821
Hunt Machine Co., Rodney, Process Equipment Div. 821
Industrial Filter & Pump Mfg. 51-53
International Boiler Works Co., The 548
International Engineering, Inc. C-114
Knight, Maurice A. 7
Koven & Brother, Inc., L. O. 834
Lead Lined Iron Pipe Co. 210
Lehmann Co., J. M. C-43
Luzerne Rubber Co., The 409
Metal-Weld, Inc., Protective Coatings Div. 240
Misco Fabricators, Inc. 723
National Lead Co. 702-706-708
New England Tank & Tower Co. 52
Perry Products Co. 437

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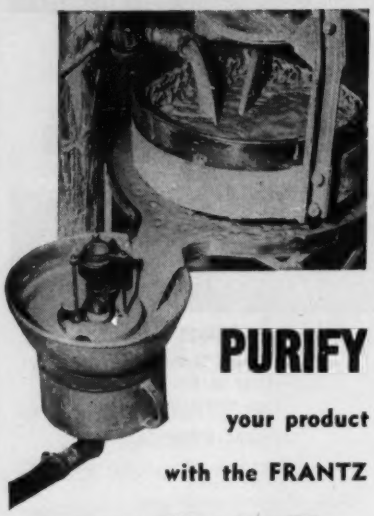

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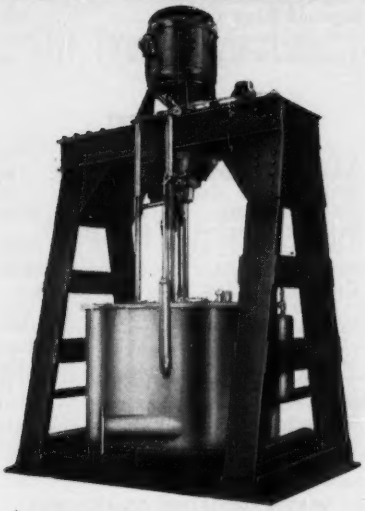

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Precision Scientific Co. 67
Pressed Steel Tank Co. 714
Ross & Son Co., Charles 447
Star Tank & Filter Corp. 129
Thermo-Panel Div., Dean Products, Inc. 744
Terriss Div., Consolidated Siphon Supply Co. 244
United States Stoneware Co. 10-12-14

THERMOMETERS

Bailey Meter Co. 30
Fischer & Porter Co. 200-202
Kimble Glass Co. 408
Kontes Glass Supply Co. C-154
Minneapolis-Honeywell Regulator Co., Industrial Div. 531
New York Laboratory Supply Co. C-41
Pharmaceutical and Chemical Industry Supply Corp. C-55
Rochester Mfg. Co. 422
Scientific Glass Apparatus Co. 54
Taylor Instrument Cos. 36
Welch Mfg. Co., W. M. C-42

THICKENING AND DEWATERING MACHINERY

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Ampco Metal, Inc. 913
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Imperial Brass Mfg. Co., The 439-441
Ingersoll-Rand Co. 918

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General Ceramics Corp. 37
Haveg Corp. 534
Johns-Manville Sales Corp. 508
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Lapp Insulator Co., Process Equipment Div. 814
Podbielniak, Inc. 601
United States Gasket Co. 740
United States Stoneware Co., The 10-12-14
York, Co., Otto H. 516

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American Agile Corp. 817
Black, Sivalls & Bryson, Inc. 114
Blickman, Inc., S. 407
Corning Glass Works 25-27
Downington Iron Works, Div. of Pressed Steel Tank Co. 714
Duriron Co., The 58-59
General Ceramics Corp. 37
Haveg Corp. 534
Knight, Maurice A. 7
Lapp Insulator Co., Process Equipment Div. 814
Misco Fabricators, Inc. 723
Patterson-Kelley Co., The ..... 739 & 831
Pfaudler Co., The 502
Treadwell Construction Co. 729
United States Stoneware Co., The 10-12-14
York Co., Otto H. 516

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Cleveland Worm & Gear Co. 72
Great Western Mfg .Co. 741-743

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Jeffrey Mfg. Co., The 201
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Minneapolis-Honeywell Regulator Co., Industrial Div. 531
New York Air Brake Co. 333-335
Philadelphia Gear Works, Inc. 33
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Anderson Co., The V. D. C-129
Black, Sivalls, & Bryson, Inc. 114
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Walworth Co. 525
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Allegheny Ludlum Steel Corp. 28
Alpha Plastics, Inc. S-108
Aluminum Co. of America 233-235
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Armco Steel Corp. 231
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Bishop & Co. Platinum Works, J. 809
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Doré Co., John L. C-139
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General Alloys Co. 748
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General Lead Construction Corp. C-27
Haveg Corp. 534
Hewitt-Robins Inc. C-14
Imperial Brass Mfg. Co., The 439-441
Industrial Steels, Inc. 726
International Nickel Co., The 507
Kimble Glass Co. 408
Lead Lined Iron Pipe Co. 210
Luzerene Rubber Co., The 409
Machlett & Son, E. C-33
Misco Fabricators, Inc. 723
Murray Co., A. B. S-32
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National Tube Div., United States Steel Corp. 518-522
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Union Steel Corp. 440
United States Gasket Co. 740
United States Stoneware Co., The 10-12-14
Wolverine Tube Div. of Calumet & Hecla, Inc. 642-644

TURBINES

Allis-Chalmers Mfg. Co. 934
General Electric Co., Apparatus Sales Div. 850
Westinghouse Electric Corp. 60
Worthington Corp. 840-848

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Hanovia Chemical and Mfg. Co. C-17, C-19, C-21
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Westinghouse Electric Corp. 60

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American Instrument Co. 736
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Ampco Metal, Inc. 913
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Automatic Switch Co. 646
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Black, Sivalls & Bryson, Inc. 114
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Fischer & Porter Co. 200-202
Foster Engineering Co. 208
General Alloys Co. 748
General Lead Construction Corp. C-27
General Ceramics Corp. 37
Grinnell Co. 50
Hamer Valves, Inc. C-123, C-127
Haveg Corp. 534
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Ladish Co., Tri-Clover Div. 26
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Luzerne Rubber Co., The 409
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National Lead Co. 702-706-708
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New York Air Brake Co. 333-335
Nicholson & Co., W. H. 132
Parks-Cramer Co. 727
Pfaudler Co., The 502
Philadelphia Gear Works, Inc. 33
Powell Co., The Wm. 48
Pressure Products Industries, Inc. C-37
Research Controls C-134
Rockwell Mfg. Co. 617
Saran Lined Pipe Co. 343
Spraying Systems Co. 833
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Haveg Corp. 534
Heil Process Equipment Corp. 622-624
Jeffrey Mfg. Co., The 201
Mine Safety Appliance Co. C-34
Niagara Blower Co. 600
York Corp., Industrial Div. 402
Young Radiator Co. C-162

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Derrick Mfg. Co. C-28
Great Western Mfg. Co. 741-743
Gump Co., B. F. 23
Jeffrey Mfg. Co., The 201
Knapp Mills, Inc. and Andrews-Knapp Construction Co. 19
Ingersoll-Rand Co. 918
New Brunswick Scientific Co. 626
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Ace Glass Inc. 710
American Instrument Co. 736
Bailey Meter Co. 30
Brabender Corp. C-35
Brookfield Engineering Laboratories, Inc. 424
Ferranti Electric, Inc. S-67
General Electric Co., Apparatus Sales Div. 850
Kontes Glass Company C-154
Machlett & Son, E. C-33
Martinson Machine Co. C-136
New York Laboratory Supply Co. C-41
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Allis-Chalmers Mfg. Co. 934
American Water Softener Co. S-64
American Well Works, The C-160
Barnebey-Cheney Co. 17
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Hungerford & Terry, Inc. 205
Illinois Water Treatment Co. 630
Industrial Filter & Pump Mfg. Co. 51-53
Lapp Insulator Co. 814
Machlett & Son, E. C-33
Permutit Co., The 73
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Research Controls C-134
Terriss Div., Consolidated Siphon Supply Co. 244
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WELDING EQUIPMENT

American Agile Corp. 817
Ampco Metal, Inc. 913
Industrial Steels, Inc. 726
International Nickel Co., The 507
Westinghouse Electric Corp. 60
Whitehead Metal Products Co. 429

WIRE CLOTH—WIRE MESH

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Cambridge Wire Cloth Co. 214
General Alloys Co. 748
Great Western Mfg. Co. 741-743
Hewitt-Robins Inc. C-14
Industrial Steels, Inc. 726
Multi-Metal Wire Cloth Co. 204
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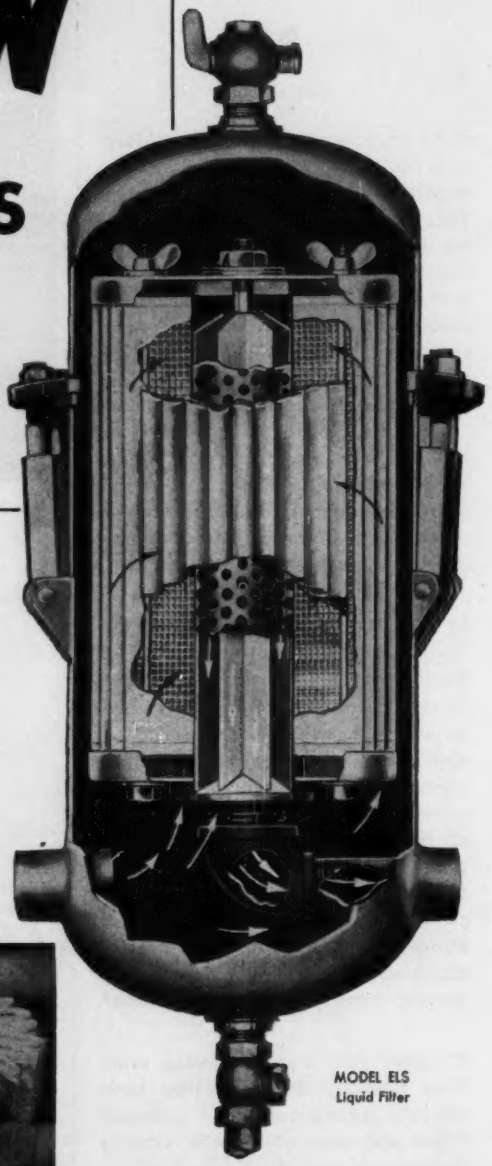

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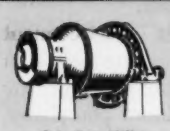
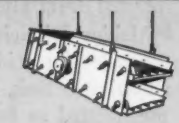
A-4596

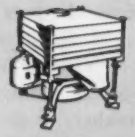
Other Processing Equipment for the Chemical Industry


Grinding Mills

Kilns, Dryers, Coolers

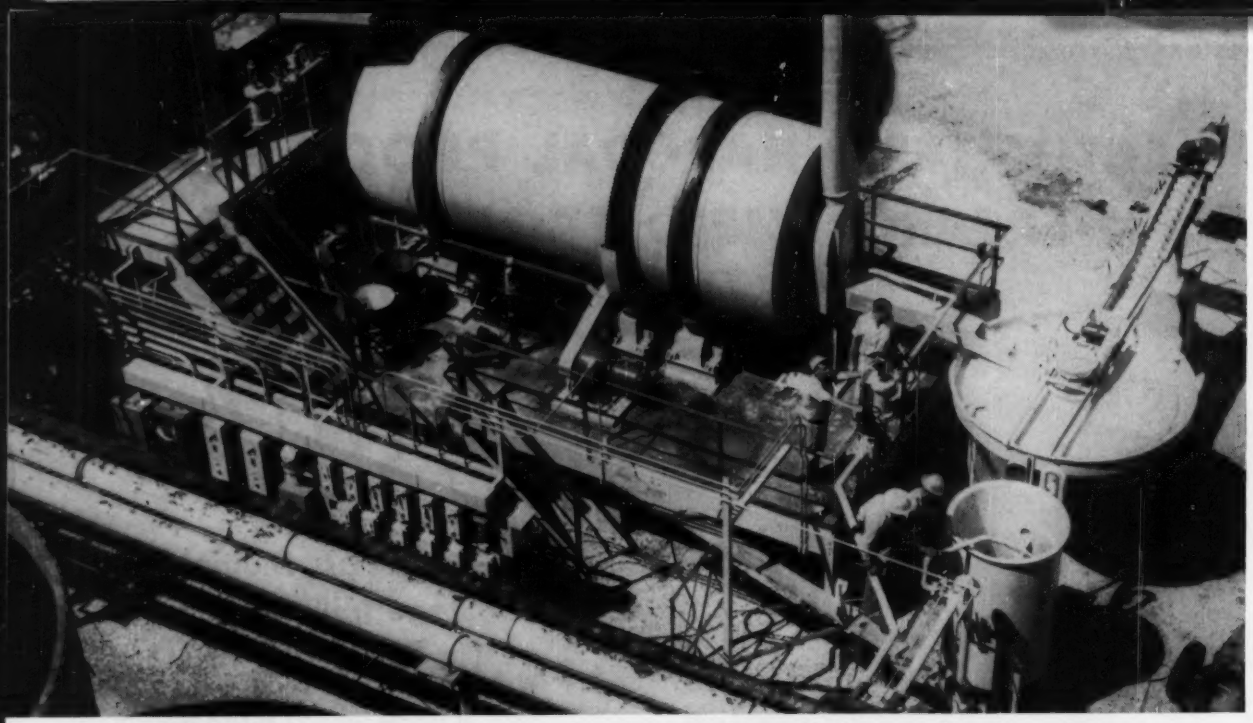

Vibrating Screens

Compacting Mills


Gyratory Screens

Man-Lifts

ALLIS-CHALMERS



SLAKED LIME (above) and wet-process phosphoric acid react in this new plant for making . . .

Dicalcium Phosphate

Cheap, but contaminated, wet process phosphoric acid is used in this pioneering process for making an important feed supplement.

A CHEMICAL ENGINEERING PICTURED FLOWSHEET

Pioneering a new process usually involves a shakedown and adjustment period. Texas City Chemicals' new dicalcium phosphate plant, at Texas City, Tex., is no exception to this rule.

But now in full production, the plant economically makes 160 ton/day of feed-grade dicalcium phosphate (and 40 ton/day of fertilizer-grade) from wet-process phosphoric acid, once considered an impractical raw material.

► **Why Wet-Process Acid?**—Dicalcium phosphate is an excellent concentrated animal feed supplement, for which there's a growing demand. But as such, it must contain low (0.1%) concentrations of poisonous fluorine.

That's why most DCP producers start with fluorine-free, electric-furnace-derived phosphoric acid, and react this with lime ($Ca(OH)_2$) to make dicalcium phosphate.* However, furnace acid is expensive, except under very favorable conditions (cheap electricity, nearby source of acid).

► **The Problem Is Solved**—Wet-process acid is relatively cheap to make—sulfuric acid reacts with phosphate rock, producing phosphoric acid and gypsum ($CaSO_4 \cdot 2H_2O$). But it is dilute and has high concentrations of fluorine.

Texas City has solved the problem of how to economically eliminate this fluorine. It isn't removed completely before forming any DCP—that would be a costly operation.

Instead, only 20% of the fluorine is first removed from the acid by reacting with a saturated brine solution. The remainder is precipitated with the 40 ton/day of fertilizer grade DCP, and the fluorine-free filtrate further treated with lime to produce feed-grade material.

► **How the Process Works**—Sulfuric acid is made at Texas City Chemicals by converting sulfur to 98% H_2SO_4 in a 400 ton/day contact plant. The acid (together with spent acid from an adjacent Carbide and Carbon plant) reacts with ground Florida phosphate rock.

This ground rock first feeds into a wetting tank, where it mixes with recycle phosphoric acid, then flows by gravity to the first of a series of four digesters. Here the reaction between rock and sulfuric produces phosphoric acid and gypsum.

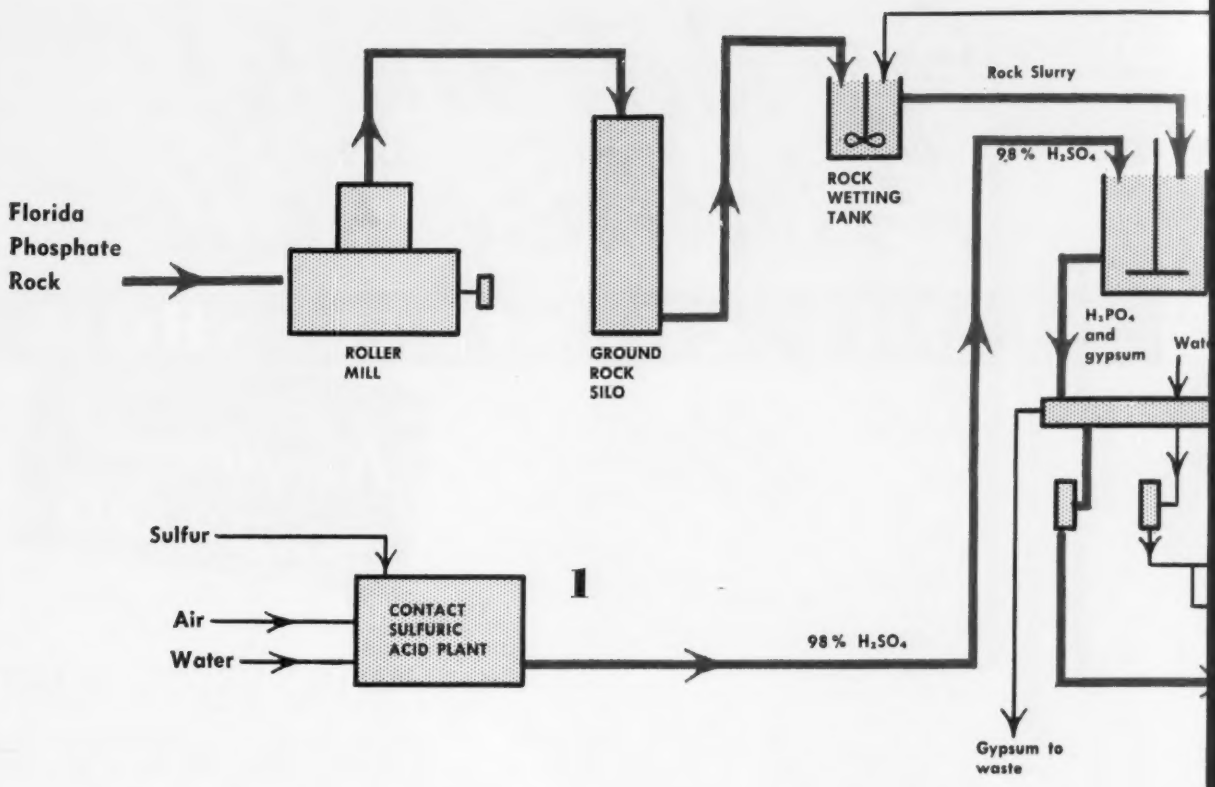
The gypsum is filtered on rotary horizontal filters, operating on steam jets using steam generated in the sulfuric acid plant. Gypsum goes to waste, and the phosphoric flashed cooled to a 20% concentration.

In primary defluorination, saturated brine solution, added to the H_3PO_4, reacts with the fluorine compounds, forming sodium silico fluoride. This is filtered on an internal drum filter and sold as a byproduct.

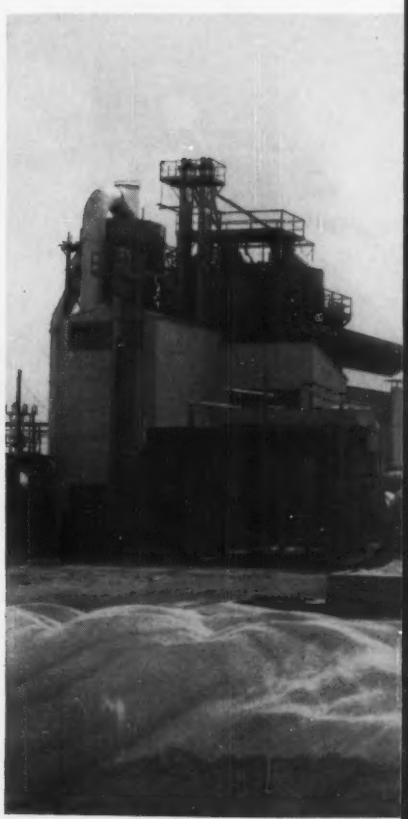
► **Making Dicalcium Phosphate**—The first lime treatment converts the acid to monocalcium phosphate liquor in an agitated tank, while the majority of the impurities are precipitated as fluorides, iron and aluminum phosphates, gypsum and dicalcium phosphate. This is filtered on drum vacuum filters, dried in a Roto-louvre dryer, pelletized and sold as fertilizer containing 35% available P_2O_5.

The filtrate is limed in a second agitated tank to dicalcium phosphate, and filtered on a vacuum drum filter. It's then flash dried and bagged. Final product is about 98% DCP with a maximum of 0.1% fluorine.

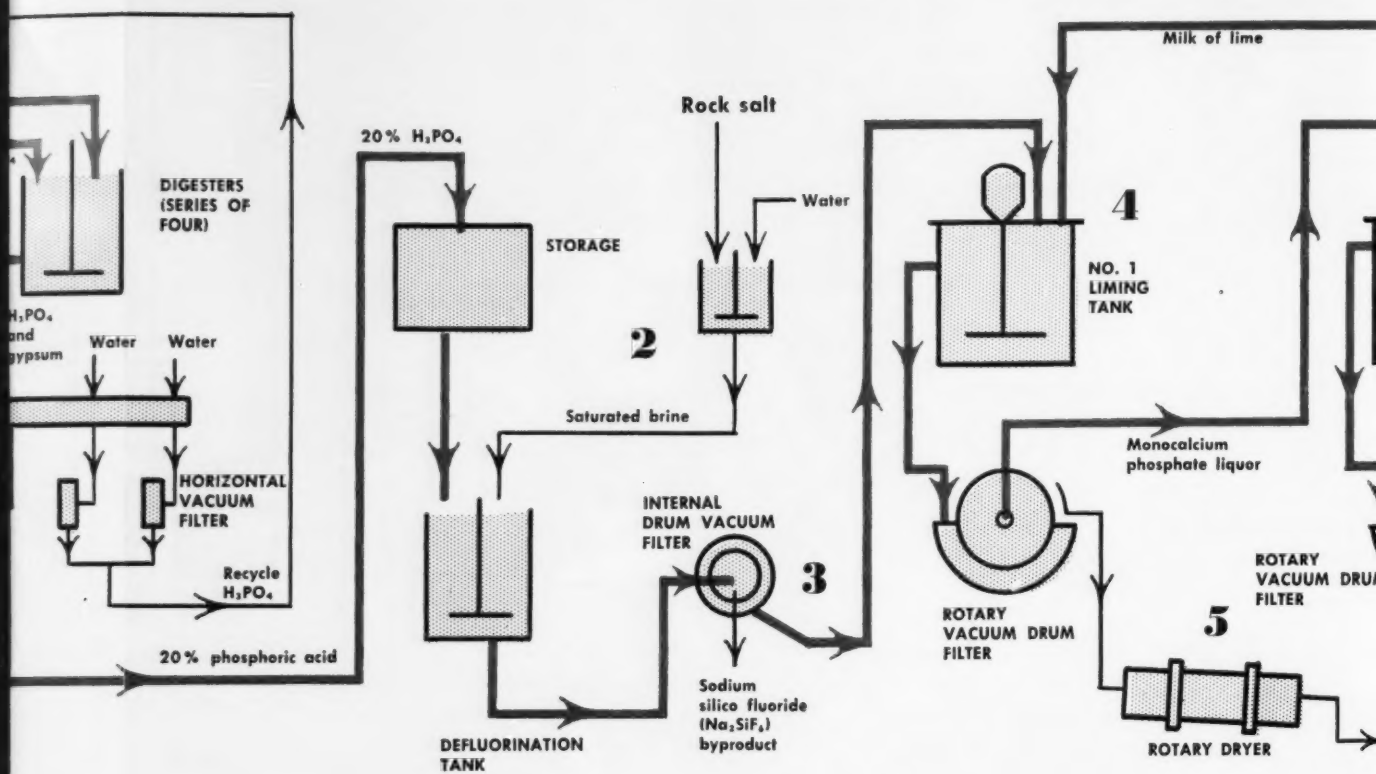
*There are five such producers (American Agricultural, Hoosic Valley Lime, Monsanto, Victor and Shea). Only Texas City and International Minerals & Chemical use wet-process acid, but some DCP is also produced as a glue byproduct. Productive capacity from all sources: 368,000 ton/yr.

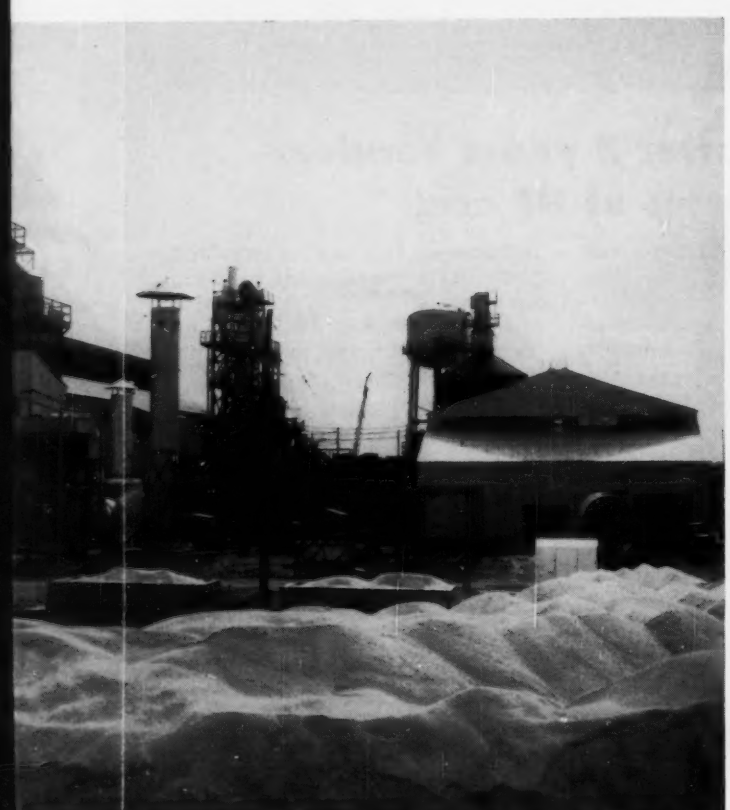


1 SULFURIC ACID plant (background) and water treatment equipment (foreground). The contact acid plant makes 400 ton/day of 98% sulfuric.

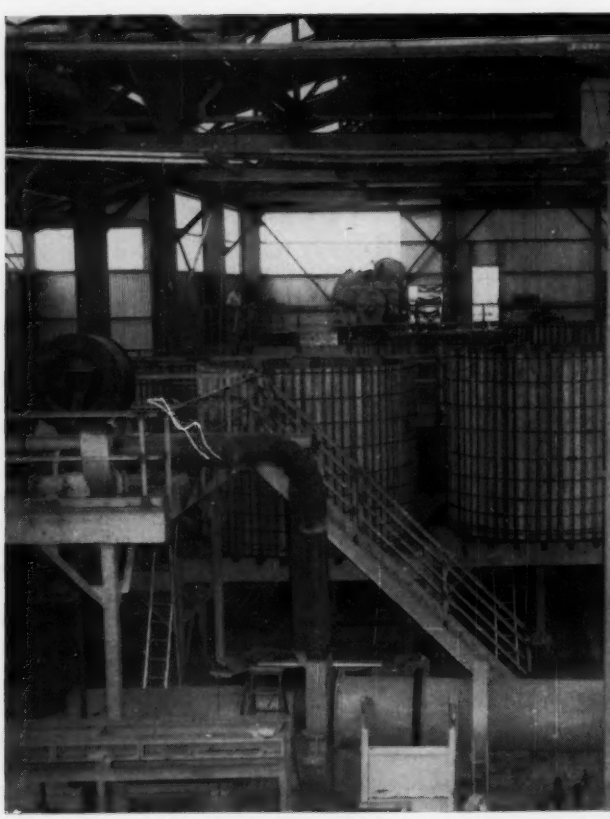


2 BRINE PREPARATION, with rock
nation of phosphoric acid—where fluo

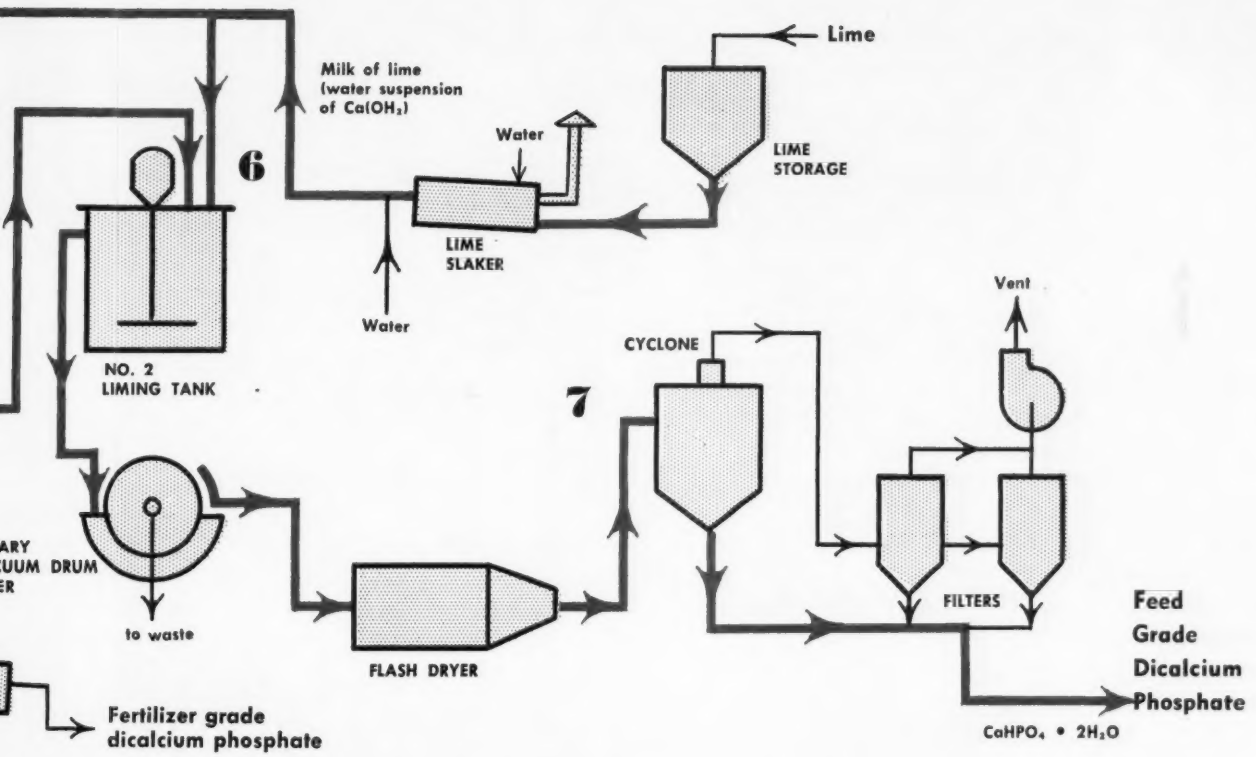




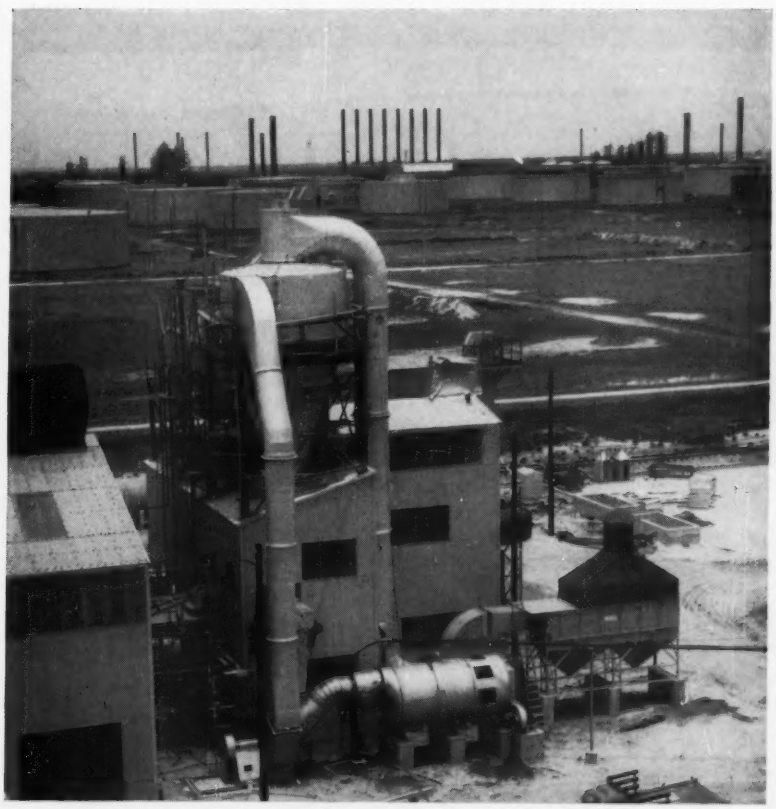
, with rock salt in foreground. The saturated solution is used in primary defluori-
—where fluorine is precipitated as sodium silico fluoride.



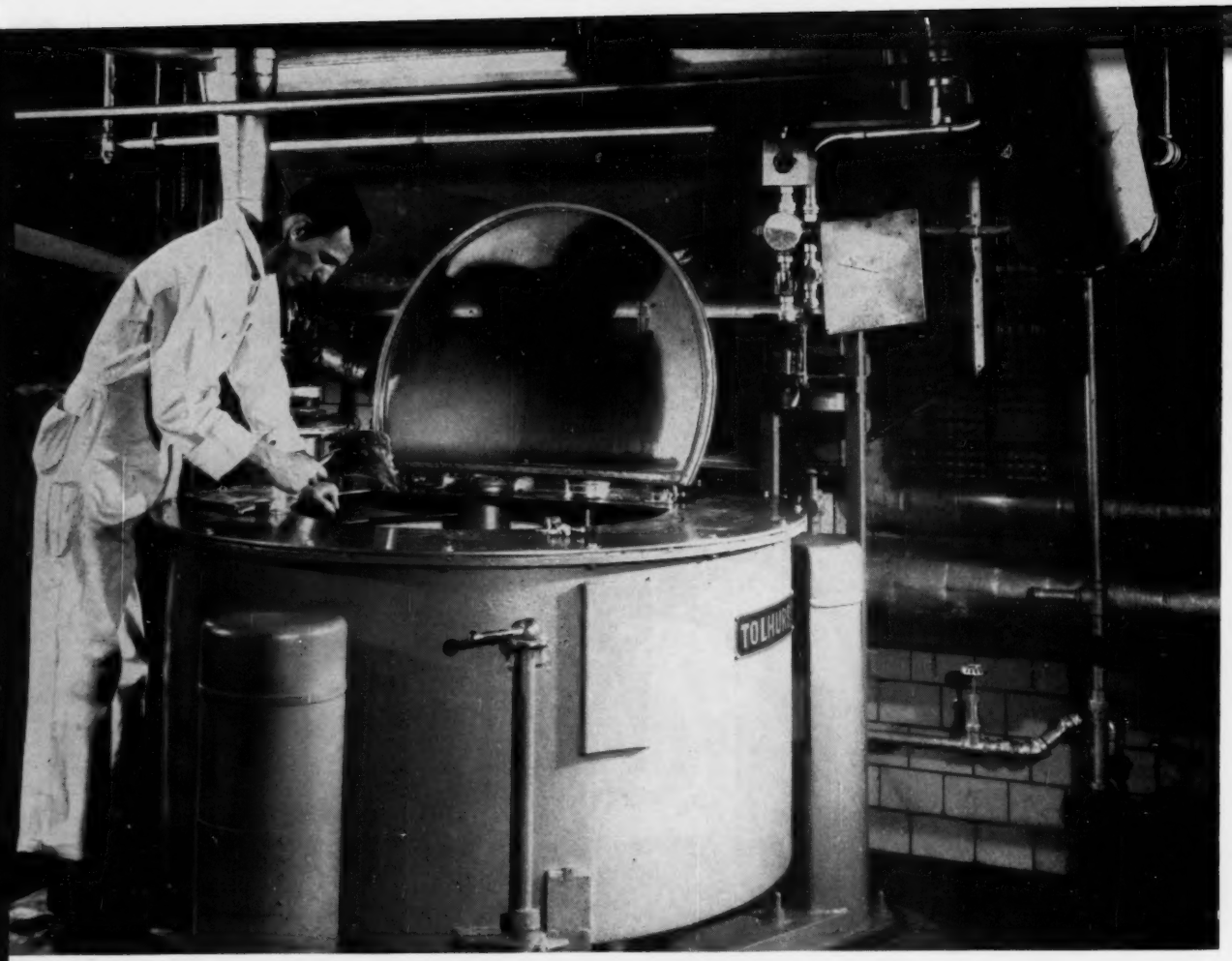
3-6 DICALCIUM PHOSPHATE unit—An internal drum
Also shown are the lining tanks (4) (6). The rotary drye



rnal drum filter (3) removes sodium silico fluoride. otary dryer (5) handles fertilizer grade material.



7 FLASH DRYING of the final product. The unit, including dryer, cyclone and dust filters produces a 98% feed-grade dicalcium phosphate.



How to improve centrifugal efficiency as much as 300%

Any good centrifugal will separate liquids from solids. But there's an important difference in the out-of-balance loads that they can *safely* handle . . . and, in the years of trouble-free service you will get.

For example, laboratory tests plus records from the field show clearly that a Tolhurst Center-Slung® Centrifugal will handle up to 300% greater out-of-balance payloads than possible with ordinary centrifugals. And it's all due to the unique Tolhurst design and engineering. The improved chain link suspension, housed in grease-packed sleeves and mounted in neoprene buffers, controls vibration and permits the revolving mass to find its own center of gyration. Thus, bearing stress, which accompanies unbalanced loads, is relieved; excessive vibration dampened; and friction reduced.

A Tolhurst can switch back and forth at a moment's notice between materials of different viscosities. No wonder trouble-free service for 20, 30 and even 40 years is not unusual for a Tolhurst.

Your Tolhurst Centrifugal, either Center-Slung or Suspended, can be built of any material that can be fabricated by normal shop methods. You can choose from a wide range of basket capacities, perforate or imperforate construction. Or, if your process calls for continuous centrifuging, the NEW Tolhurst "Maxi-Flex" has many exclusive advantages.

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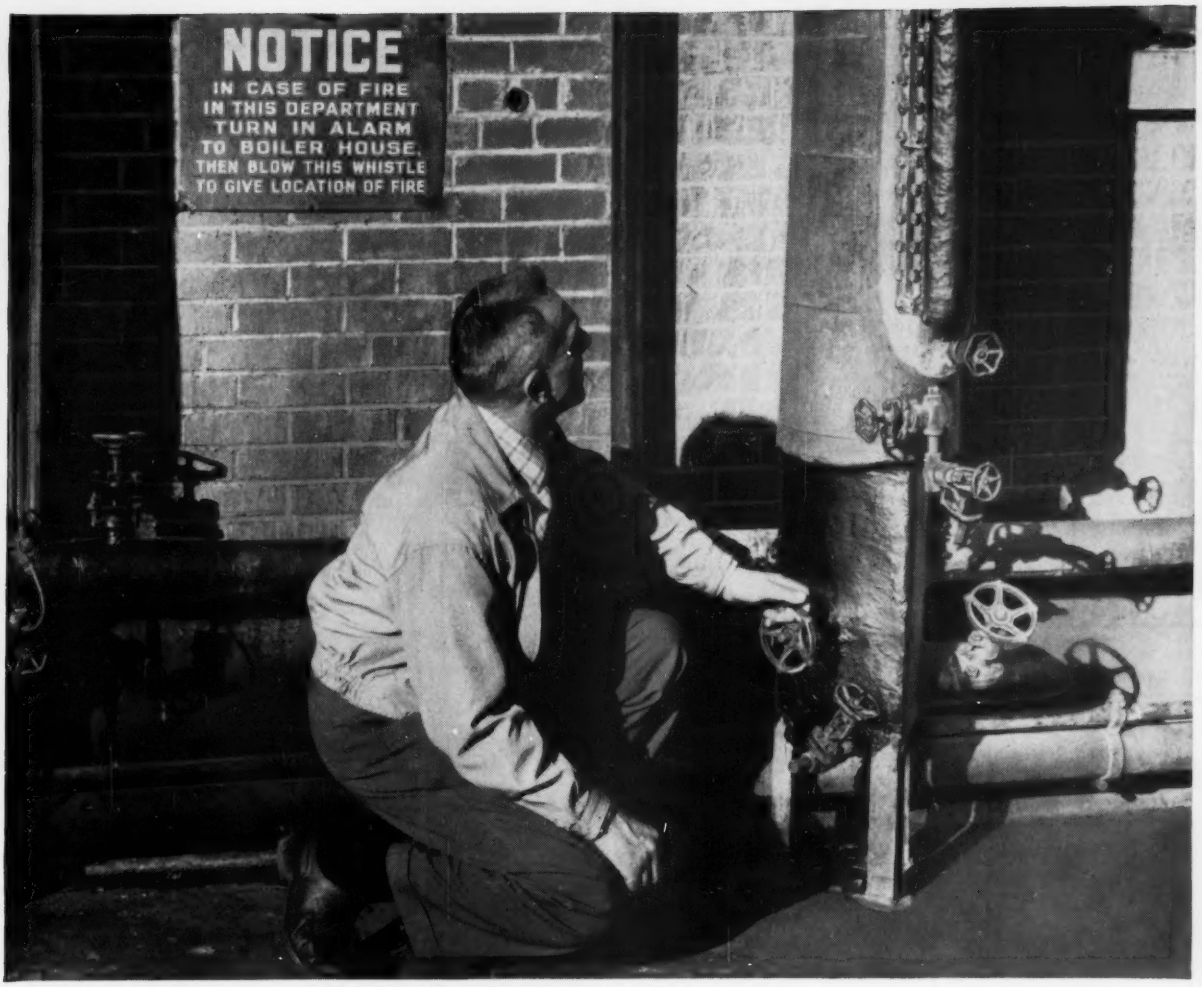

No valve maintenance after 3 years' service —even with traces of HF acid

THE CASE HISTORY—This installation is at Continental Oil Company's Ponca City refinery, on their HF alkylation unit.

The service is on the debutanizer reflux drum water draw, with traces of hydrofluoric acid present at times. Working pressure is 100 psi. at 120° F.

The Crane valves on this service —No. 3609A, 600-pound small steel valves with Monel trim—were installed more than 3 years ago. Operating cycle is 4 times per shift around the clock.

Needing no maintenance whatsoever since installed, these valves have always made tight closure with smooth, easy operation. They show no leakage nor corrosive effects while continued safe and satisfactory service indefinitely is indicated.

No. 3609A Crane steel gate valves have a long, outstanding service record on HF alkylation units. They are recommended specially for anhydrous hydrofluoric acid, and where mixtures of the acid and hydrocarbons are found. Crane Monel trim combined with features such as extra deep stuffing box with spacer for lubrication, and male-female bonnet joint with soft iron gasket, assures finest performance from these valves. In gate and globe patterns; sizes up to 2 in., with screwed or flanged ends. See your Crane Represenative for valuable help in specifying and ordering.

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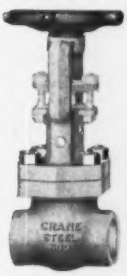

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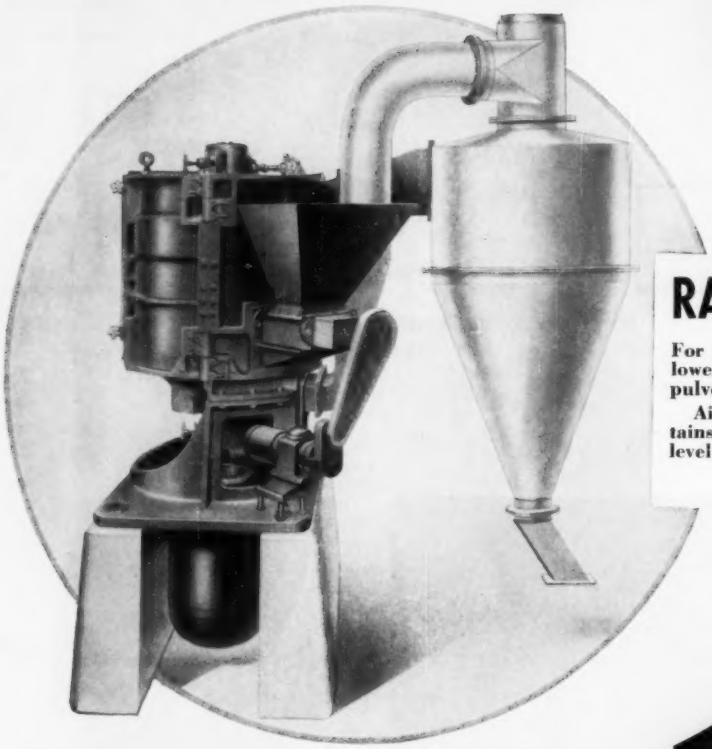
Raymond BOOTH 68

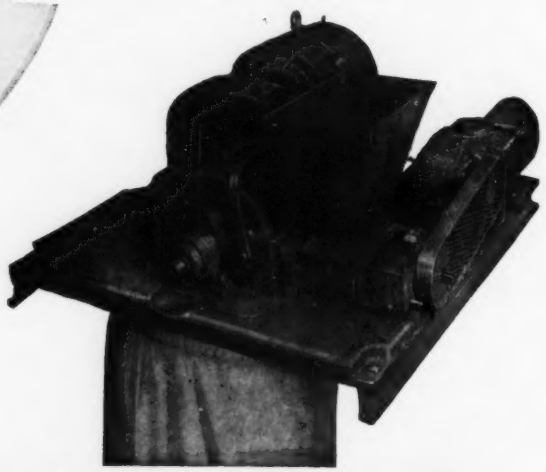


RAYMOND VERTICAL MILL

For producing superfine powdered materials in the lower micron sizes beyond the range of an ordinary pulverizer.

Air separation with the Whizzer Classifier maintains consistent uniformity required by today's high level specifications.

See Bulletin No. 70



SINCE 1887

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C. Andrew Stokes: Man of the Month

Chemical engineer is elected VP and technical director of Texas Butadiene & Chemical Corp.

In an age of intensive and extensive specialization, the man who can bridge the gap between the training of the businessman and the engineer plays a key role in his firm's advancement. Industry's greatest need for this sort of transition arises when someone must come up with a level-headed cost estimate before any proposed project is given the green light.

This ability to synthesize economic analysis and engineering know-how is one of the main reasons why Dr. C. A. Stokes is now vice president and technical director at Texas Butadiene & Chemical Corp.

For his latest appointment, Stokes will locate his headquarters in Houston. The move to the land of the tumbleweed will facilitate his handling heavy responsibilities at Texas Butadiene's new plant there.

The $20-$25 million project will produce finished aviation gasoline or, alternately, alkylates for blending into commercial motor fuels and butylenes. In addition, it will produce butadiene for synthetic rubber, nylon and other products.

▶ **Jack-of-Many-Trades**—Though his experience centers in the research and development field, Stokes' abilities range in many other directions. Barely 40, versatile Andy Stokes quickly scaled the chemical ladder. After earning a BS in ChE at the University of Florida, in 1938, he began a seven-year teaching stint at MIT. Then, because of his wide range of interests, Stokes soon tried his hand at consulting work. Toward the end of his teaching career, he took on additional responsibilities in an advisory capacity for the American Resinous Chemicals Co., in Peabody, Mass. Soon after, Boston's Godfrey L. Cabot, Inc., and the government's Office of Production Research & Development retained him. And, within a few short years, Cabot monopolized his time by appointing him Director of Research & Development, in 1945.

▶ **"Dollar Esperanto"**—According to Stokes, top brass normally can't spare the time to master the technical details of a project. In fact, management's interest is often courted only by the scent of big profits or the dread of crippling losses. Here, Stokes claims, engineers are of optimum value. They've got to give management economic perspective and the mutual language, "The 'Esperanto' that can be learned by the engineer and businessman alike is the language of dollars." Thus the engineer can help management to a quick yes or no decision through a combination of technical and business know-how.

▶ **Time Out**—A busy man, Andy has little time to take it easy. Three prime demands on his spare hours, though, are his young sons: Jeffrey, 9; Harry, 8; and Christopher, 6. Like any father, Andy confesses that he gets some of the biggest kicks out of showing his sons how better to do the things that young boys like to do.

And, whenever he can, Andy says he takes a few minutes to putter in the garden. As a matter of fact, friends claim he can't do anything without becoming a student of it. They say he can sound off on the "fine print" of the art of gardening for his present New England home. What's more, they predict that—with his green thumb—he can size up any other area in no time at all.

▶ **Always Room for One More**—Any busy man manages to find time to squeeze an extra assignment into his crowded schedule. But when that man is as versatile as Andy Stokes, the practice can be extended ad infinitum—or mighty close to it.

In 1951, he was selected Vice President and Director of the Petrocarb Equipment firm—New York manufacturer of special high temperature processing equipment for solids and liquids. He's an active member of the national AICHE and, on the local level, he can be identified with the "Ichthyologists"—alias adopted by the Boston section.

Soon after Stokes became Cabot's representative to the Industrial Research Institute. Here, he worked with the membership committee in the selection, education, rating and training of technical personnel. Earlier this year, he was also elected to the Institute's board of directors to serve a term of three years.

Names in the News continued on p. 378

FIRE HAZARD FOILED!

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Wherever highly combustible materials are used – as in this "dope room" at the Athol Manufacturing Company's Massachusetts plant, a potential fire hazard is *always* present!

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NAMES . . .

Glenn E. Pratt–Member of the production dept. at Monsanto Chemical Co.'s plastics div. in Texas City, Tex. Formerly, Pratt had been with du Pont.

G. L. Bridger–Joins Davison Chemical Co. as director of agricultural research. Dr. Bridger had been head of the dept. of chemical & mining engineering of Iowa State College.

Clarence E. Larson–Appointed VP in charge of research for the National Carbon Co. Dr. Larson had been the director of the Oak Ridge National Lab operated by Union Carbide for the AEC.

W. L. Bulkley–Head of equipment development section for Standard Oil Co. (Indiana). **Andrew Dravnieks** will take charge of the corrosion section.

Cecil Waller and **Robert Berriman**–Recipients of Edward Longstreth Medals of the Franklin Institute of the State of Pennsylvania, for their work in the "development of photographic emulsions."

Glen H. Shoptau–Advanced to the position of senior engineer in Monsanto Chemical Co. **A. E. Withrow** is now senior engineer in the process investigation section.

Carlton L. Horine–Senior process engineer at Brea Chemicals, Inc. Horine had been with the US Naval Ordinance Test Station in Inyokern, Calif.

Ray V. Mihailovich–Joined the staff of the B. F. Goodrich Co. research center, Brecksville, Ohio, as a junior technical man.

Robert C. Anderson–Manager, staff laboratories engineering dept., for Minnesota Mining & Mfg. Co.

Harry B. Temple–Vice president of Robertshaw-Fulton Controls Co. to take on research and de-

velopment responsibilities. Retired Rear Admiral Temple will be located in the Washington office.

Robert M. Jackson—First chemical products coordinator of all phases of world-wide petrochemical operations for Standard Oil Co. (N. J.)

Patrick H. Hobson and **Eugene L. L. Ringwald**—Group leaders in the research and development dept. at Chemstrand Corp.

Rudy Peterson—Senior process engineer at American Potash & Chemical Corp.

Andrew K. Forthmann—President and General manager of both the Los Angeles Soap Co. and the White King Soap Co.

Sampel T. Page—Director of the chemical dept. at Sam Tour & Co., Inc., New York.

M. A. Ellsworth—Head of Fluor Corp.'s new engineering and construction division as VP and general manager.

Solomon Epstein—General manager of Emulsol Chemical Corp., div. of Witco Chemical Co.

George W. Blum—New addition to the chemical engineering staff at Goodyear Tire & Rubber Co.

Edwin M. Haun—Monsanto's new inorganic development manager for the Overseas division.

Edward G. Scheibel—Appointed director of engineering at the Otto H. York Co., Inc.

Leonard Smiley—Manager of technical coordination at Sylvania Electric Products' Atomic Energy Div.

R. A. Dresselly—Promoted to technical specialist for the technical service div. at Humble Oil & Refining Co.'s Baytown, Tex., refinery. Mr. Dresselly will

ACCO product

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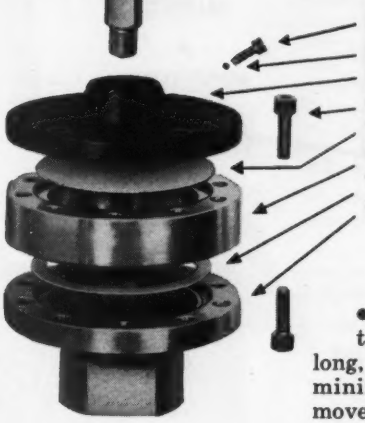
FEATURES



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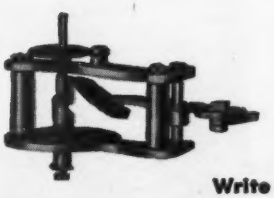

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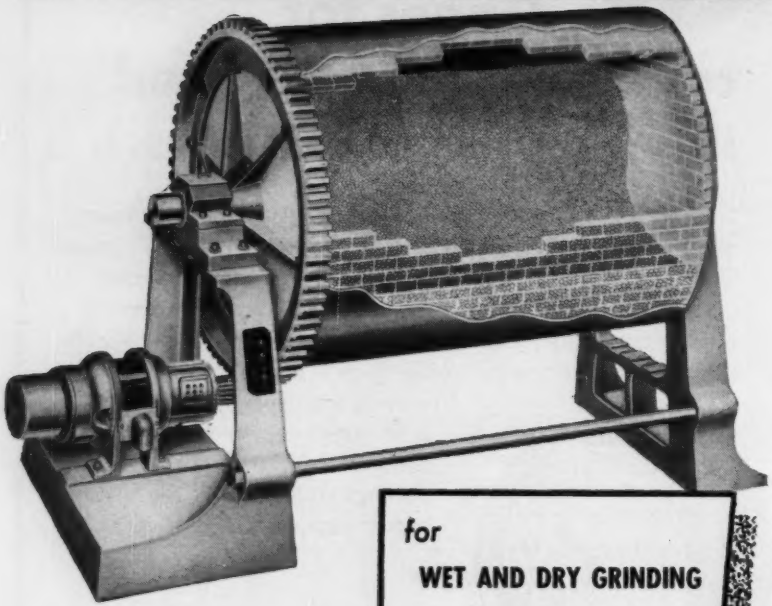

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NAMES . . .

concern himself with optimizing operatings at the newly acquired butadiene unit.

F. M. McMillan–Appointed head of the polymer and chemical applications dept. of Shell Dev. Co's Emeryville, Calif., research center.

J. F. Horner–Section head in the process design section of American Oil Co.'s research & development dept.

Arnold R. Jackson–Latest addition to the chemical engineering staff at Schering Corp. Previously, Mr. Jackson had been associated with Wallace & Tiernan, Inc.

Swanton D. Dalton–Appointed to the newly-created position of assistant general manager of manufacturing in charge of technical coordination for Socony Mobil Oil.

Gwilym A. Price–Elected chairman and president of Westinghouse Electric Corp. at a recent meeting of the Board of Directors. The board chairmanship has not been occupied since 1951.

C. S. Wiedman–Appointed manager of carbide products development engineering at GE's carboloy dept. He will concentrate on metallurgical development.

John A. Casey–Joined the staff of Procter & Gamble Co.'s research & development dept.

Sophocles G. Pappas–New member of the production dept. of Monsanto's plastics div. John MacPherson has joined the polyethylene production dept.

William R. Ludka–Promoted to the post of manager of the engineering research dept. at Minnesota & Mining Mfg. Co.

Joseph L. Seger–Elected to the Board of directors of Esso Research & Eng. Co. Mr. Seger is executive VP of Carter Oil Co.

Paul E. Gishler–Manager of research & development at the Canadian Chemical Co., Ltd., Dr. Gishler has headed the chemical engineering section of the Nat'l Research Council in Ottawa, since 1943.

Francis E. Blacet–Chairman of technical advisory committee to advise the Air Pollution Fdn., Los Angeles. Dr. Blacet is chairman of UCLA's dept. of chemistry.

E. J. Fox–Appointed Assistant Works Manager of Carbide & Carbon Chemicals Co. Formerly, he had been plant supt. in Texas City.

C. H. Case–Appointed a division manager for Kaiser Engineers Div. of Henry J. Kaiser Co.

Homer Fry–New supt. of production for the Coal Chemicals Div. of Pittsburgh Coke & Chemical Co.

G. Morgan Homewood, Jr.–Marketing Research manager of J. T. Baker Chemical Co.

Walter M. Fenton–Director of the newly-formed dept. of product research & development at Lithium Corp. of America.

Dudley P. Fernandes–Joins the process study group at Hooker Electrochemical Co.

J. Dean Herman and **Gerald A. Munson**–Are Lithium Corp.'s chief chemical engineer and chief mineral engineer.

Samuel A. Goldblith–Associate Professor of food technology has been selected executive officer of MIT's dept. of food technology.

F. D. Parker–Named VP-Engineering for the petroleum div. of Blaw-Knox Co., Tulsa.

Edwin O. Joesting–Appointed manager of research and pro-

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In addition to manufacturing a complete line of 150 lb. stainless steel screwed fittings CAMCO can supply your requirements in pressure rated heavy duty stainless steel pipe fittings. Most of the popular sizes and items are available from stock in types 304, 304ELC, 316 and 316 ELC stainless steel screwed and socketweld fittings. Wide reinforcing bands insure maximum strength at points of stress and extend well beyond the last thread or depth of socket. All fittings permanently identified with size, alloy, pressure rating, heat code and trademark.

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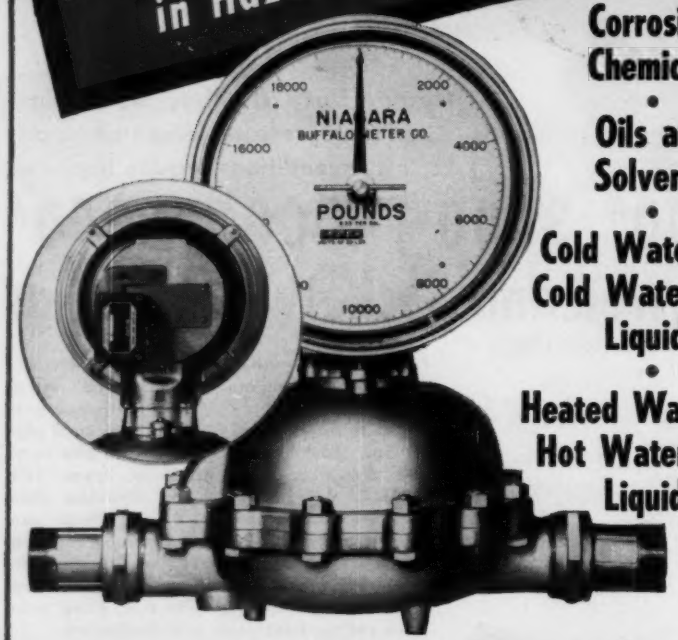
for Automatically Measuring and Controlling Liquids in Hazardous Atmospheres



Corrosive Chemicals
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Oils and Solvents
•
Cold Water and Cold Water Base Liquids
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For CHEMICAL PROCESSING PLANTS

Shuts solenoid valve or stops pump motor after preset gallonage has flowed through the meter. Opens or closes circuit to actuate any electrical controls. Provides automatic shut-off for batch measurements. Insures accuracy. Saves time. Increases production without increasing man-power requirements. Wide range of sizes and capacities of both Meters and Electricontact Registers.

Design incorporates Model EX-AR Microswitch which carries Underwriter's Laboratories listing for use in hazardous atmospheres, Class 1, Group C and D and Class 2, Group F and G. Electricontact register has new improved heavy duty construction. Used on 110 to 550 V. a.c.

Brings automation to liquid volume measurement and control even in hazardous atmospheres.

For Complete Details Write for Bulletin 35

BUFFALO METER CO.
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Representatives in all leading industrial centers

NAMES . . .

duct control for Minnesota Mining & Mfg. Co. Lewis Lehr is manager of technical service.

Warren L. Hardy—The Norton Co.'s new business research manager.

Robert M. Jackson

World-wide petrochemical operations of Standard Oil Co. (New Jersey) have been placed in the hands of Robert M. Jackson as the firm's first chemical products coordinator.

In his new position, Jackson will serve as an assistant coordinator in the Refining Coordination Dept. in charge of chemical products.

Associated with the Jersey Standard organization for 21 years, he had previously served as assistant manager of the chemical products division of Esso Standard Oil Co.

W. E. Breitenbach—Selected as executive VP of Alaska Pine & Cellulose Ltd., Vancouver, B. C. He had served as VP for Rayonier Inc., in charge of manufacturing.

Ross Brian and **James R. Allen, Jr.**—Joined Central Soya Co., Inc., as senior chemical engineer and director of field service, respectively.

Richmond M. Stampley—Becomes Dorr-Oliver's new western filtration div. manager.

John A. Page—Named to the post of chief supervisor for the Polyisocyanates Area at Du Pont's Chambers Works in New Jersey.

William M. Larson—Promoted to the rubber and plastics compounding section for Goodyear Tire & Rubber Co.'s research div.

Richard S. Brief—Now a commissioned officer with the U. S. Public Health Service's Air Pollution Control Program.

Morse J. Gavender—New member of the economic staff of Stanford Research Institute's Portland, Ore., office.

Gordon P. Larson—Vice President of Oxy-Catalyst, Inc. Larson was the former smog control director of Los Angeles County.

Raymond P. Rossman—Director of research & development of Godfrey L. Cabot, Inc., Boston.

John L. Chynoweth—Transferred from du Pont's Orange, Tex., plant to Belle, W. Va., where he will be assistant supt. in the nylon development section.

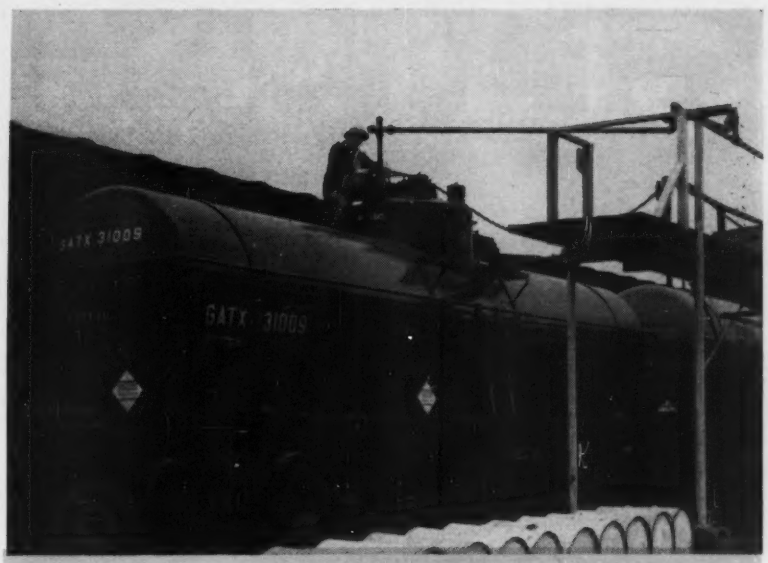
Stanley T. Hirozawa—Joined the analytical dept. of the research and engineering div. of Wyandotte Chemicals Corp.

Alexander L. Guterma—Elected chairman of the board of United Dye & Chemical Corp. **V. D. Dardi,** former chairman of the board has been elected president and chief executive officer.

Gerald P. Radzinski, Aquila R. Finley, Robert T. Moore, John F. Shea Jr., and **Harry Dreifus**—New members of the chemical engineering staff of Hooker Electrochemical Co.

Robert J. Minchak and **Robert F. Singer**—Joined the staff of the B. F. Goodrich Research Center in Brecksville, Ohio. Mr. Minchak had been associated with the US Army Chemical Center, Md.

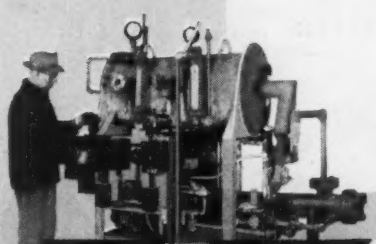
H. J. Buttner—Appointed manager of engineering for the Le Roi div. of Westinghouse Air Brake



STAUFFER CHEMICAL PLAYS SAFE WITH GAS ATMOSPHERES' GENERATOR IN CHEMICAL TRANSFER OPERATION

To transfer Carbon Bi-sulphide safely from tank car to storage Stauffer Chemical Company's Niagara Falls plant purge their lines and tanks and prime transfer pump with a nitrogen gas. To get this gas in necessary amounts as inexpensively as possible, Stauffer purchases a Gas Atmospheres Generator that produces high purity nitrogen from the combustion of hydrogen, which was readily available, and air. The generator has been operating faithfully, with negligible maintenance for seven years.

If your operation requires a gaseous atmosphere, talk with Gas Atmospheres' engineers — be sure you have the most efficient and dependable equipment available. Production and cost estimates, literature available upon request. Just let us know type and amounts of gas required.



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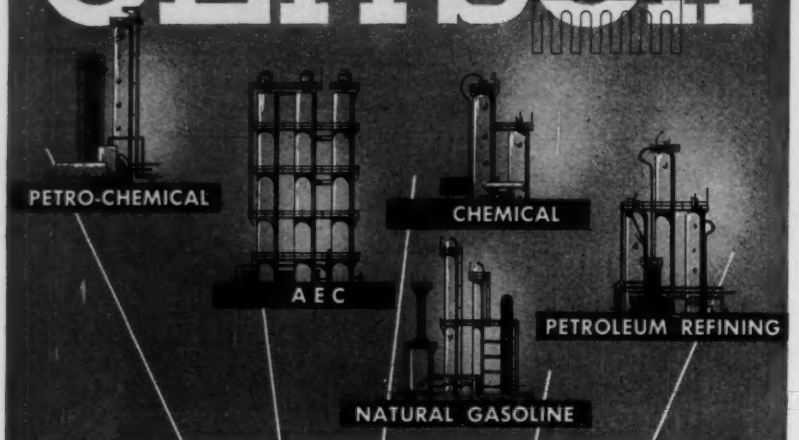
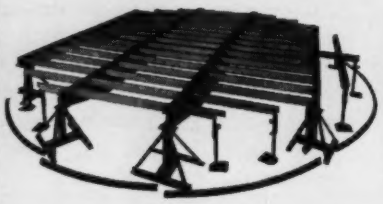


In all types of processing plants GLITSCH equipment allows greatest design latitude in tray size, process layout, type of flow, type and shape of downcomer, weirs, and size and shape bubble caps as well as suitable corrosion resistant material. Use of GLITSCH "Truss-Type" lightweight trays and bubble caps has produced such outstanding reductions in "off-stream" time that entire investments have been repaid quickly. GLITSCH sales engineers are located in principal chemical processing areas.



This is the GLITSCH "Truss-Type" mechanical structure which allows complete freedom of design for your process requirements.

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SAVINGS are effected in design, fabrication, installation and maximum "on-stream" performance.

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NAMES . . .

Co. Previously, he had held an engineering management position with Continental Motor Corp.

Arthur Minich—Elected VP of Heyden Chemical Corp. Mr. Minich will continue as president of Nuode Products Co., Inc. **Thomas M. O'Neil** has been elected a VP in charge of sales and marketing.

R. S. Reynolds, Jr.—Elected chairman of the board of Robertshaw-Fulton Controls Co. He succeeds his father R. S. Reynolds, Sr. who died July 29.

S. H. McAllister—Director of Shell Development Co.'s agricultural research div. in Denver, Colo. Formerly, Mr. McAllister had been with the firm's research center in Emeryville, Calif.

Glenn C. Putnam—Transferred from du Pont's Sabine River Works to the firm's Victoria plant. Mr. Putnam is a technical supt.

M. J. O'Neal—Named to receive the Precision Scientific Company Award in Petroleum Chemistry for 1956 at Shell Oil Co.

R. F. Laskey—Rejoined the staff of the research & development dept. at Proctor & Gamble Co. after completing a tour of duty with the US navy.

Raymond F. Stevens—Joined the Acheson Colloids Co. as research chemist.

Carl A. Gerstacker—Named a vice president at a recent board of diectors meeting of Dow Chemical Co.

Julian M. Avery—Director of the product development div. of Ethyl Corp. Avery joined the firm in 1952 as a technical advisor.

Willard F. Libby—Recipient of the $1,000 ACS Award for Nuclear Applications in Chemis-

try. Dr. Libby, of the USAEC, is the inventor of the screen-wall Geiger counter.

Harry S. Ferguson—Elected to the Board of directors of the MCA. Mr. Ferguson is a vice president at Allied Chemical & Dye Corp.

Albert H. Cooper—Chairman of the dept. of chemical engineering at Pratt Institute. Dr. Cooper has been a professor at the University of Maryland.

Paul Bachman—Elected VP and director of research & development for Koppers Co., Inc. Dr. Bachman had held an equivalent position, previously, at Davison Chemical Co.

James E. Matush and **Charles W. Hack**—New additions to Du Pont's technical section at the Sabine River Works, Orange, Tex.

William T. Hack—Elected president of the Snyder Chemical Corp. Mr. Hack succeeds Ashworth N. Stull.

Calvin H. Mohr—New assistant to the president at D. R. Sperry & Co., Batavia, Ill. He had been associated with Velsicol Corp.

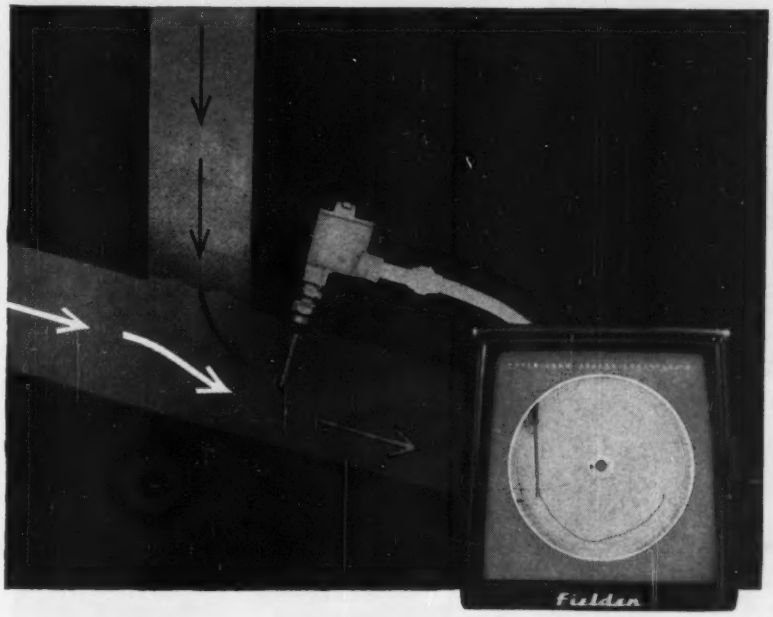
George F. Clifford, Jr.—Sales manager of the Spinco Div. of Beckman Instruments, Inc.

Shelby A. Miller—Now Chairman of the dept. of chemical engineering at the University of Rochester. Dr. Miller had been professor at the University of Kansas.

George C. Stier—Appointed assistent VP in charge of the Plastics Div. at Nopco Chemical Co. The div. will open two new plants this year and a third in 1956.

C. J. Aydelotte—Head of the new polyisocyanates organization taking shape at du Pont's Chambers Works in New Jersey. Mr.

Continuous Analysis of Process Streams Now Simplified by Fielden Unit



Engineers in many process plants are now continuously analyzing process streams successfully for composition, purity, or moisture content without the bother of complex, time-consuming laboratory techniques.

The only equipment used for these measurements consists of a Fielden R. F. Capacitance Bridge Recorder-Controller and a single-unit capacitance probe. If the process stream mixture changes its dielectric constant, the capacitance measured at the probe changes accordingly. By continuously measuring product capacitance, the recorder shows the composition of the process stream at all times.

This system is extremely simple and offers many unusual features. For example, it can be supplied with explosion-proof housings and electric or pneumatic controls. The Fielden R. F. Capacitance Bridge Recorder-Controller has a full-scale response of 3½ seconds . . . a sensitivity of ±0.05% . . . an accuracy of ±0.25% . . . and a stability of ±0.25%. Send the coupon now for full details.

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- ☐ TEKTOLOG Recorder-Controllers
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- ☐ TELSTOR Continuous Level Indicator

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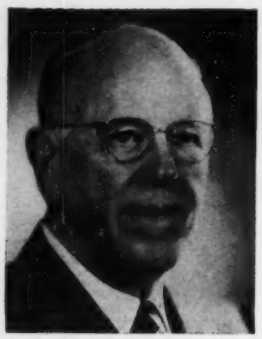
Aydelotte has been with the firm for many years as a heavy chemicals supt.

Harry G. Drickamer–Recipient of the $3,000 Ipatieff Prize of the ACS for his high-pressure research.

Martin G. Gale–Named director of technical service for the Monomer Dept. at Borden's Chemical Div.

Robers M. Hainsfurther–Appointed manager of Pittsburgh Plate Glass Co.'s $34 million plant now under construction at Cumberland, Md.

OBITUARIES



Edwin Letts Oliver

Founder-chairman of Dorr-Oliver, Inc., Edwin Letts Oliver, died suddenly at his Lake Tahoe, Calif., summer home, on Aug. 28.

Best known for his work in the field of continuous filtration, the 77 year old executive had been the inventor of the Oliver continuous filter. The unit became the cornerstone of the Oliver Continuous Filter Co. founded in 1910 by Mr. Oliver to market his invention.

Because of development and expansion, the formation of Oliver United Filters, Inc. became necessary in 1928. Oliver served as president of his firm until its merger with the Dorr Co. last year. He then became Dorr-Oliver's board chairman.

In earlier years, Mr. Oliver had designed and built several cyanide plants in California. He had also been the recipient of many honors including the James Douglas

Medal of the American Institute of Mining & Metallurgical Engineers.

Kenneth J. Latimer, 49, Gulf Oil Corp. chemical engineer, died Sept. 3 at Port Arthur, Tex. Mr. Latimer had been with the firm for 25 years.

Graham Edgar, 68, who developed the octane scale, died after a long illness. Dr. Edgar had been a consultant with the Ethyl Corp.

David Crampton, chief chemical engineer for Wallace & Tiernan, Belleville, N. J., was drowned off the Jersey coast, late in August.

Charles P. Gulick, honorary chairman of the board of Nopco Chemical Co., died in his 70th year after a brief illness. Mr. Gulick had been one of the founders of Nopco.

Herman H. Harris, VP of Chemicals, Inc., Oakland, Calif, manufacturer of household cleaners, died in mid-August at the age of 60. He had been one of the firm's founders.

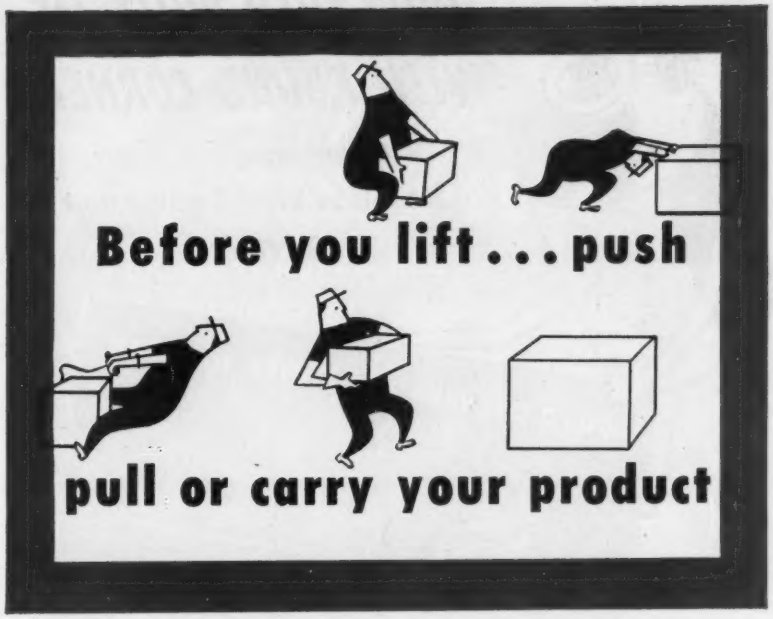
Albert Hermann, 63, founder and director of the Western Pine Assn's research lab for 30 years, died in Portland of a heart attack.

Howard T. DeRemer, works manager, Selas Corp. of America died suddenly at his home in Pennsylvania last August.

Herbert J. French, 62, VP of International Nickel Co., Inc., died in Rochester, Minn., after an extended illness.

Frank L. Bass, chief chemist of Keystone Portland Cement Co., died suddenly on Aug. 21 at his home in Easton, Pa.

M. P. Cortilet, 59, VP of American Can Co.'s central div., died suddenly, Aug. 22, at his Chicago home.



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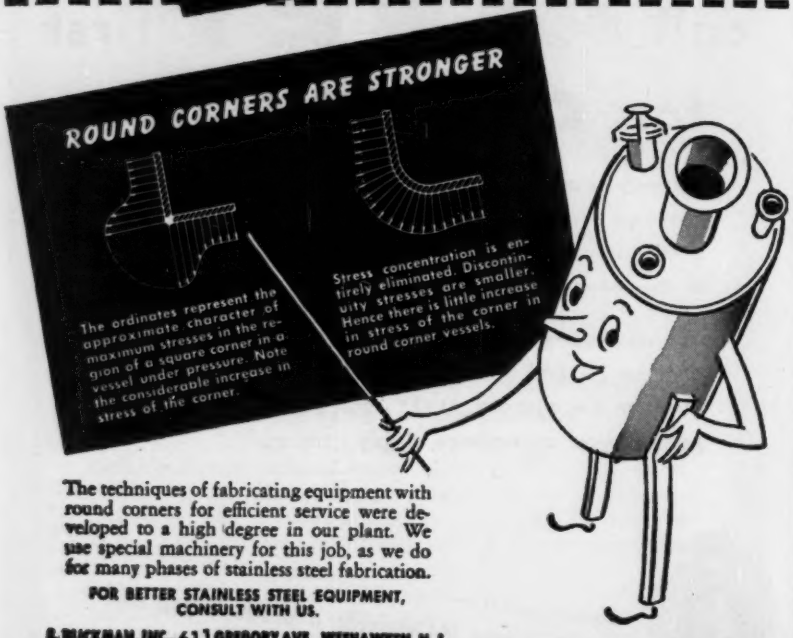
Even the best brushes require extra time to clean accumulations gathered in square corners. With gummy material or material that hardens, complete removal may never be possible.
In Blickman round-corner construction the brush has no difficulty in cleaning the entire surface of the round corner. This saves time and reduces the danger of contamination and corrosion.


ROUND CORNERS ARE STRONGER
The ordinates represent the approximate character of maximum stresses in the region of a square corner in a vessel under pressure. Note the considerable increase in stress of the corner.
Stress concentration is entirely eliminated. Discontinuity stresses are smaller. Hence there is little increase in stress of the corner in round corner vessels.

The techniques of fabricating equipment with round corners for efficient service were developed to a high degree in our plant. We use special machinery for this job, as we do for many phases of stainless steel fabrication.

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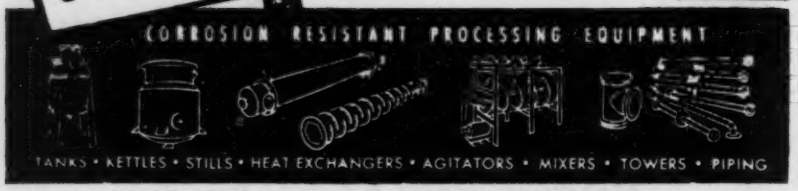
A request on your letterhead will bring our guide, "What to Look for When You Specify Stainless Steel for Your Processing Equipment."



We welcome you to our exhibit at the Exposition of Chemical Industries, Commercial Museum and Convention Hall Booth No. 407, Philadelphia, Pa., December 5-9

THIS MONTH'S *Technical*

20,000 + 8,000

TECHNICAL SPELLER. By G. G. Hawley and A. W. Hawley. Reinhold Publishing Corp., New York. 146 pages. $2.95.

Many years ago I discovered "20,000 Words." This small book is just what the doctor ordered for all of us who have to check our spelling, hyphenation and word division. That's what it does—spells and syllabicates.

Now the Hawleys have eased our task even further. Their speller does the same job on some 8,000 chemical and other technical terms. It will be most useful to chemical engineers and chemists, but other fields (electronics, medicine, physics, metallurgy) are represented. Some trade names and proper names are also included.

If you ever have trouble between aba·ca and zy·mur·gy, ask the Hawleys. They put the proper letters in the proper sequence for you.—LBP

Vital Auxiliaries

PULP AND PAPER MANUFACTURE. Vol. 4. J. Newell Stephenson, Editor-in-Chief. McGraw-Hill Book Co., New York. 732 pages. $9.

Capstone of a decade of editorial effort and over 25 thousand miles of editorial travel this volume fills to overflowing the technological storehouse of the pulp and paper industry. For the four-volume series chronicles the complete technology of the industry from start to finish. It's authoritative, probing and detailed; the product of dozens of manufacturers and hundreds of prominent engineers.

In winding up the series with Vol. 4 coverage is given to equipment which, though not actually a part of the manufacturing process, still is vital in an auxiliary role. For instance, Part I on instrumentation and process control

Bookshelf

L. B. Pope

details major manufacturing variables that can be measured, why it is necessary to measure them and how they may be controlled. Fundamentals of installation and operation serve as an operator's reference. Illustrations are sufficiently large to be intelligible, no mean feat for instrument elements.

Application of instrumentation peculiar to the pulp and paper industry in Part 2 shows how the principles outlined in Part 1 are used in many papermaking operations. Altogether, 246 pages are given over to instrumentation and control.

Other auxiliary equipment, operations and services are: pumps, pumping apparatus and agitation equipment; materials handling; heating and ventilation; steam; water; electrical equipment; bearings and lubrication.—csc

Metallic Depositions

VAPOR-PLATING. By C. F. Powell, I. E. Campbell and B. W. Gonser. John Wiley & Sons, New York. 158 pages. $5.50.

Reviewed by M. Kolodney

The past two decades have witnessed an ever-increasing demand for materials capable of withstanding stress and corrosion at elevated temperatures or materials possessing these traits combined with desirable nuclear properties. Much of this demand derives from the need for high-speed aircraft driven jet engines, but new chemical processes and the young atomic power industry have contributed not a little to the general cry for superior materials of construction. In the search for these, many materials have failed to receive consideration because of excessive cost or poor fabrication characteristics or because they are simply too scarce. Frequently, a relatively thin coating may suffice, but no method of ap-

easily installed in split-case pumps

This new addition to the "JOHN CRANE" family of anti-corrosive Type 9 Seals is the answer to a simplified means of seal installation (or removal) in modern split-case pumps.

Need for unbolting the upper half of the casing is eliminated, since the unit is mounted on a sleeve with an outside clamping ring.

Sealing members of DuPont Teflon readily adapt this seal to the handling of chemicals, solvents and corrosives, plus high temperature and similar conditions under which rubber cannot be used.

Springs and metal parts are furnished in the metallurgical specification best suited to the service.

Wherever "hard-to-handle" liquids or gases are involved . . . temperatures from −90° to +485°F . . . pressures to 750 psi . . . the "John Crane" Type 9 Seal is *the* seal for your pump.

Get complete facts and engineering data on the "John Crane" Type 9 Packaged Seal with outside clamping ring. Contact Crane Packing Co., 1809 Belle Plaine Avenue, Chicago 13, Ill. *In Canada: Crane Packing Co., Ltd., 617 Parkdale Ave., N. Hamilton, Ont.*

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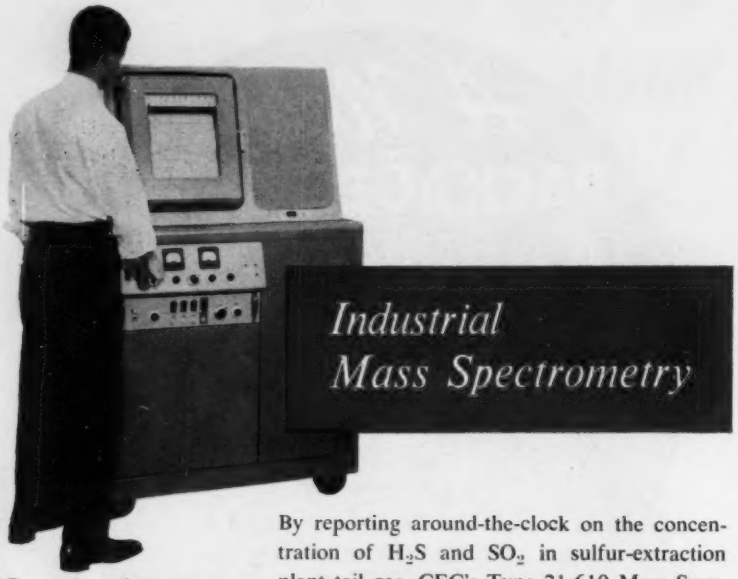

Here's how it pays off in sulfur recovery

By reporting around-the-clock on the concentration of H_2S and SO_2 in sulfur-extraction plant tail gas, CEC's Type 21-610 Mass Spectrometers pay off in two important ways. By means of its continuous, accurate monitoring, the ratio of the two gases in the stream can be controlled within critical limits, which increases the profitable elemental sulfur output by as much as *1½ tons per day* in a typical plant. And, important to community relations, air pollutants are reduced to an absolute minimum, for when the ratio is just right, the release of harmful, irritating sulfur compounds to the atmosphere is practically eliminated.

Now... two process-monitoring mass spectrometers

For monitoring and controlling streams to mass 80

TYPE 21-610 is moderately priced and a truly general-purpose instrument. Although primarily designed for continuous petroleum and petrochemical stream analysis, it is also valuable for production-line leak detection or laboratory analysis. Its applications have ranged from on-the-spot acetylene-plant monitoring to hospital clinical tests on lungs.

For higher resolving power and readings to mass 150

TYPE 21-620 has the highest mass range of any instrument in its compact size range. Using the new "Cycloidal Focusing" principle, it goes beyond the 21-610 for accurate readings from mass 2 to mass 150. Medical laboratories, petrochemical plants and general research organizations will all find it ideal for their analytical problems.

Send for Bulletin CEC 1824A-X28.

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plying such a coating is available. This book, sponsored by the Electrochemical Society, introduces some little-known methods of plating a variety of unusual materials.

Brevity is as admirable in book titles as in after-dinner speeches, but sometimes it leads to misunderstanding. This book covers the plating of metals—but not from metal vapors. The authors have specifically excluded vacuum metallizing and have confined themselves to a group of processes involving the decomposition or reduction of the vapors of chemical compounds. The result is a deposit of metal or metallic compound on a base which may be of wholly different character. In addition, they have covered a selected number of methods that convert a metallic base into a compound such as the carbide or nitride, although the very common procedures for carburizing and nitriding of steel have been omitted.

This book is the first devoted entirely to coatings produced from gaseous chemical compounds and is intended to serve as an introduction to the method. In fact, it is essentially a comprehensive literature review with more than 400 references. The authors have furnished few processing details and almost none on equipment. This is not astonishing because not many of the processes have advanced beyond the laboratory stage. That this condition is no measure of their ultimate importance will be obvious when it is recalled that titanium and zirconium were almost unknown metals ten years ago. Yet in this brief time they have been produced in significant quantities—and by vapor methods.

The coatings discussed in this volume include metals, carbides, nitrides, borides, silicides and oxides, with emphasis upon corrosion-resistant and refractory materials. Properties of the deposits are described in a general way only. The deposition methods reviewed include thermal decomposition as typified by the iodide process, hydrogen reduction of volatile halides and cementation from packed solids.

It is small risk to prophesy that

the need for corrosion-resistant and refractory materials will not lessen in the years ahead. This book doesn't supply many final answers, but it should prove a stimulus to workers already in the field and an excellent source of ideas for newcomers.

One Subject, Two Approaches

THERMODYNAMICS. By J. L. Finck. Bookman Associates, New York. 224 pages. $7.50.

THERMODYNAMICS. By J. F. Lee and F. W. Sears. Addison-Wesley Publishing Co., Cambridge, Mass. 543 pages. $7.50.

Reviewed by H. Y. Krinsky

Although both these recent additions to the literature cover the same subject and have the same title (and price), the viewpoint and scope of each text are widely different.

Finck's book is a study in advanced thermodynamics, intended as a text for those engaged in research and advanced work. The subjects of classical and generalized thermodynamics are discussed both as philosophical concepts and as tools to explain various phenomena.

The author differentiates at length between classical thermodynamics—where the assumption is that two properties are sufficient to determine the state of a pure substance—and generalized thermodynamics—where independent variables must be considered.

Developing this concept of generalized thermodynamics, Finck discusses the behavior of liquid helium, proposes a theory for catalysis and presents a critique of statistical mechanics.

Clearly written and concise, this book is provocative in that it (1) utilizes an approach not found in the usual text and (2) discusses the effect of variables which are generally disregarded in engineering.

Lee's and Sears' book, on the other hand, is intended primarily as an undergraduate text for

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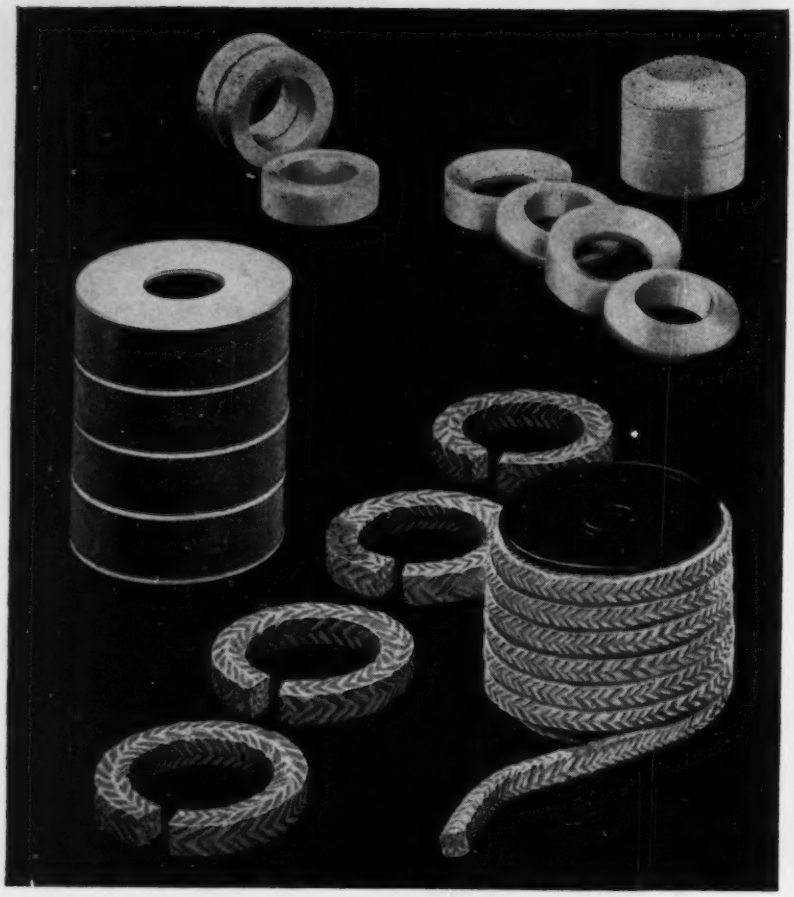

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mechanical engineering students. Those acquainted with Sears' other texts and collaborations will find this work of the same high caliber. Containing excellent diagrams, a clear text, numerous examples and problems and a logical set of symbols, this book promises to become one of the best undergraduate texts.

The authors have covered the usual subjects thoroughly giving particularly lucid explanations of the First and Seconds Laws. Certain innovations for undergraduate texts have also been made. Thus PVT relations and equations of state are discussed at the outset of the work. And the concept of entropy flow along with the Onsager reciprocal relations theory is included in the discussion of entropy.

Also included is a complete appendix devoted to the use of steam tables and another appendix giving a discussion of systems of units. Missing from this book, however, is the concept of corresponding states and the useful—though approximate—methods of obtaining thermodynamic properties based on the compressibility function chart.

While not chemical engineering texts, both these books are recommended for collateral reading. For the engineer who wants to brush up on his thermo and for the student who wishes to augment the standard texts, Lee's and Sears' book is particularly suited.

A New "Bible"

PRINCIPLES OF NUCLEAR REACTOR ENGINEERING. By S. Glasstone. D. Van Nostrand Co., New York, 861 pages. $7.95.

Reviewed by S. C. Hyman

The development of the atomic energy industry depends on specially trained manpower as much as upon any other factor. Unfortunately, we are heading for even tighter manpower bottlenecks. The Atomic Energy Commission engaged Dr. Glasstone to write the reactor engineering textbook that was needed as a basic tool by engineering educators. This book is the

result. It is splendidly done. It will do just what it was intended for, and more. A coming generation of nuclear engineer-physicists will cut their teeth on this text. I venture to predict that few of them will ever again be without it.

The title of this book raises a question. It is still early enough in the game for educators to consider whether there is any such animal as nuclear reactor engineering. Glasstone says, "The field of nuclear reactor engineering encompasses the design, construction, and operation of reactors for the release of energy in a continuous and controlled manner by the fission of certain atomic nuclei."

Examination of the book shows that there is no such animal as reactor engineering. Nothing is presented that is not already included in the basic scientific disciplines common to all physicists and engineers plus that material clearly falling into existing categories—e.g., chemical, mechanical engineering. Let there be much thought before launching a Department of Nuclear Engineering lest we attain a Professor of Chemistry of Elements 16 and 17. The people who have made reactors come from so many studies as to prove the danger of hoping to supply the industry from one curriculum.

This book of the special title makes it possible for those who study science and engineering to see how they could fit into a reactor design team if they wanted to. This is broadening and not specializing. The book shows the engineering student the fusion of training that leads to controlled atomic fission. Perhaps he will like it well enough to work at it a lifetime. For the practicing engineer, it makes it possible to comprehend this new device and to see his relation to it.

From a technical point of view, the book is very complete and startlingly up to date in its material. Financially, it is a bargain. Professionally, every scientist and engineer should browse slowly through it. When science and engineering find a new meeting ground, produce a new industry,

For ALL These Jobs—

CLARIFICATION • RECOVERY OF SOLIDS
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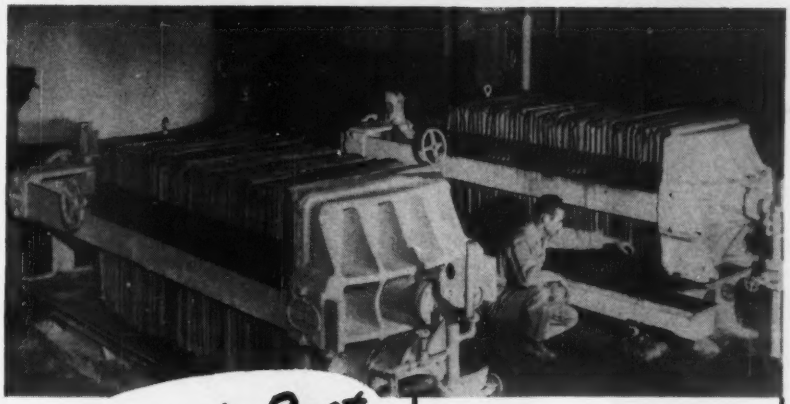
FILTER CAKE • THICKENING OF SLURRY



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a new basic source of power, which practitioner of science and engineering can afford to remain ignorant of its makeup?

A hearty thanks to the AEC for enabling Glasstone and associates to build such a clear window into the work of nuclear reactor engineering.

Case Histories

ERZ-AUFBEREITUNGS-ANLAGEN IN WEST-DEUTSCHLAND. By W. Gruender et al. Springer-Verlag, Berlin. 355 pages. $15.

Reviewed by M. Wulfinghoff

Originally conceived as a guide book in connection with the 1955 International Congress on Ore Treating at Goslar, Germany, this is an expertly written compilation of case histories.

A total of 25 plants, their layouts, principles, operational characteristics and economics are discussed in more-or-less considerable detail. Of these, eleven are installations handling lead-zinc ores, one treats copper ore, six handle iron ores. Three others prepare fluorite minerals, one handles baryte, three are potassium minerals flotation plants.

The book should be of considerable value to the practicing mining and metallurgical engineer, but will also appeal to a larger group of readers as an interesting contribution to local geography since it's readable and profusely illustrated with maps, geological sketches, flowsheets and photographs. A stimulating, well-rounded presentation.

Manganese

METALLURGY OF THE RARER METALS, VOL. 3. MANGANESE. By A. H. Sully. Academic Press, New York. 305 pages. $6.50.

Reviewed by A. Seybolt

While manganese is perhaps not generally regarded as a rare metal, it is included in the present series,

it is said, because it has been "little studied in a state of high purity." In any case, it is useful to have so much of the metallurgy of manganese available in a single volume.

There are six chapters dealing, consecutively, with history and description of ores, production of ferro alloys and pure metal, conservation and recovery from low-grade ores, physical properties, constitution of alloys and, finally, a short chapter on workability, electroplating and oxidation. The process metallurgy in the first part of the book takes up about 40% of the space and the remaining portion deals with physical metallurgy topics.

While each subject covered appears to be concisely but adequately handled, the section on manganese binary and ternary phase diagrams is particularly complete.

Although this book will be of value both to the ore process metallurgist and to the physical metallurgist, it will be a convenient and quite complete reference. It supplies information about the metallurgy and applications of manganese as a metal or alloying element.

Recent Books Received

Electronic Data Processing in Industry—A Case Book of Management Experience. American Management Assn. $5.75 ($7.75 non-members).

Handbook of Engineering Materials. By D. F. Miner and J. B. Seastone. Wiley. $17.50.

Hawley's Technical Speller. By G. G. Hawley and A. W. Hawley. Reinhold. $2.95.

Nuclear and Radiochemistry. By G. Friedlander and J. W. Kennedy. Wiley. $7.50.

Plastics for Corrosion-Resistant Applications. By R. B. Seymour and R. H. Steiner. Reinhold. $7.50.

Principles of Industrial Waste Treatment. By C. F. Gurnham. Wiley. $9.50.

Principles of Mass and Flow Production. By F. G. Wollard, Philosophical Library. $7.50.

Qualitative Organic Analysis. By A. McGookin. Reinhold. $4.50.

Quantitative Analysis of Drugs. By D. C. Garratt. Philosophical Library. $17.50.

Systematic Handbook of Volumetric Analysis. 13th ed. By F. Sutton. Butterworths Scientific Publications. 63s.

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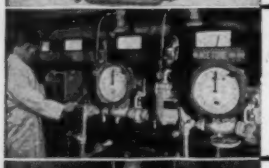
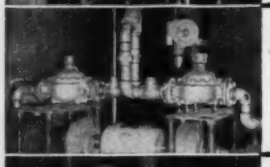
✓ **AUTOMATIC PROCESS CYCLING:** Auto-Stop meters can be equipped with electrical switches to start or stop pumps, agitators, etc. . . . automatically. Saves times, labor, power . . . with closer control.



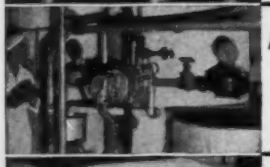
✓ **ELIMINATE REJECTED BATCHES:** In one leading pharmaceutical plant, Neptune meters eliminated human errors, saved enough costly ingredients to pay for the meters in less than a month! How's *your* "reject" rate?



✓ **EASIER INVENTORY, COST CONTROL:** Neptune Meters at key check points keep track of inventory, interdepartmental use, production rates, etc. They put a stop to waste, verify full measure received or delivered.

✓ **AUTOMATIC DRUM FILLING:** This Neptune fills drums, radiators, fuel tanks, etc., with exact quantity every time you press the handle. Saves time, labor, prevents spills or "shorts."

✓ **OIL BURNERS, DIESELS:** Use these low-flow meters instead of bulky day tanks to measure fuel consumed by boilers, melting furnaces, diesels, etc.



✓ **WATER CONDITIONERS:** Trident meter's wary eye tells when ion exchange unit needs recycling. See if yours has trouble-free Trident.

✓ **TANK TRUCK DELIVERIES:** Many industrial liquids can be delivered by metered trucks with greater ease and accuracy than markers, gauges or sticks. Investigate Red Seal meters.

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THIS MONTH'S

Recent Books

Chemical Producers

This directory lists products and plant locations of each prime producer in northern California and provides a manual of ready reference to sources of 241 products produced by 100 different plants operated by 94 producers.

"Directory of Chemical Producers of the San Francisco Bay Region and Northern California." San Francisco Chamber of Commerce, San Francisco, Calif.

Light Hydrocarbons

Collection of data on the effect of pressure and temperature on molal volumes of the lighter hydrocarbons, hydrogen sulfide and carbon dioxide resulted from a series of investigations conducted by API from 1947 to 1953. 250 pages.

"Some Properties of the Lighter Hydrocarbons, Hydrogen Sulfide, and Carbon Dioxide." By B. H. Sage and W. N. Lacey. American Petroleum Institute, 50 West 50th St., New York 20, N. Y. $10.

Research

Annual department-by-department report on the research activities at Mellon Institute. Aims and accomplishments of the various projects each department has underway in such fields as physical chemistry, instrumentation, industrial hygiene, organic chemistry. 54 pages.

"Scientific Research Activities of Mellon Institute, 1954-1955." Mellon Institute of Industrial Research, 4400 Fifth Ave., Pittsburgh 13, Pa.

Cane Sugar

What are considered to be the best chemical control techniques as applied to cane sugar production are described in this 3-part manual. Part 1 (the bulk of the text) covers in considerable detail such items as

& Pamphlets

standardization of reagents; methods of sampling and analyzing raw, intermediate and final products; sample calculations and formulas. Parts 2 and 3 discuss, respectively, the importance as well as the ways and means of setting up periodic reports on plant operation and taking of plant inventory. A highly worthwhile investment for any one in cane sugar production—from the plant owner, manager and chief engineer down to the plant operator. 116 pages.

"Recommended Methods for the Chemical Control of Cane Sugar Factories." Compiled by Arthur G. Keller. Engineering Experiment Station Bulletin No. 50, College of Engineering, Louisiana State University, Baton Rouge, La. $1.

Wood

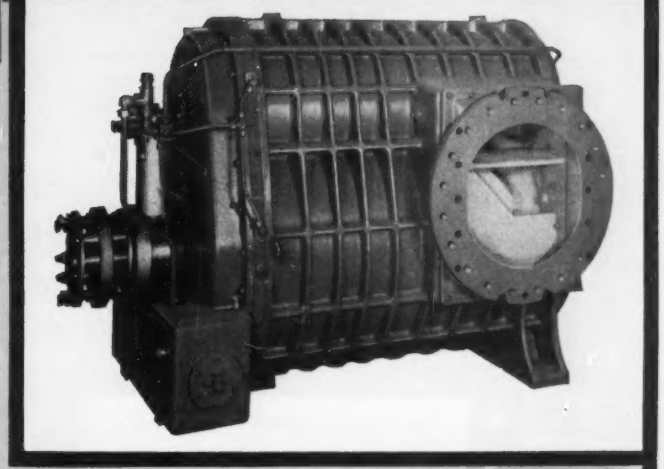
New edition of a basic reference book on the properties and structural uses of wood. Completely new sections on building fiberboards and on modified woods and paper base laminates; extensive revisions in sections on structural sandwich construction, plywood and other cross banded products, glued wood lamination. 528 pages.

"Wood Handbook." 1955 edition. Superintendent of Documents, Washington 25, D. C. $2.

Worldwide Atomic Energy

Report on survey questions answered by 32 countries contains information on the organization and principal personnel of their atomic energy programs, their principal laboratories and research centers, major physical research equipment they possess, their activities in the utilization of radioisotopes, their international arrangements for cooperation.

"World Development of Atomic Energy." Atomic Industrial Forum, 260 Madison Ave., New York 16, N. Y. $5.



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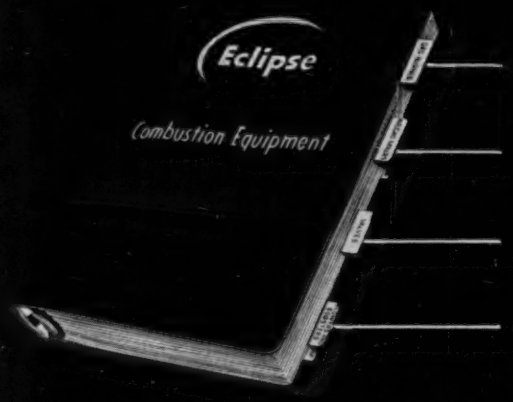

Eclipse offers most complete line of combustion equipment for the chemical processing industry

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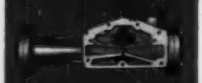
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A partial list of applications of Eclipse combustion equipment includes: atmosphere generators; oil crackers; air heaters; oil treating units; drying units; high- and low-temperature solution heaters; distillation and evaporation units; ceramic firing and rubber curing.

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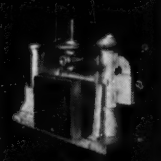
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Solenoid Valves

Safety Shut-off Valves

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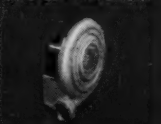
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PROCESS HEATING

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THIS MONTH'S *Firms in*

New Locations

Metal & Thermit Corp.'s United Chromium Div. has moved its Chicago sales office to 415 East 151 St., East Chicago, Ind., where new warehousing facilities have been established for the division.

Diamond Black Leaf Co. has moved its headquarters staff from Richmond, Va. to the Union Commerce Bldg., Cleveland.

Quickdraft Co. has moved its general offices and manufacturing facilities from Hamilton to Canton, Ohio.

De Laval Pacific Co. has opened for business at a new address at 201 East Millbrae Ave., Millbrae, Calif.

International Nickel Co. has moved the central Atlantic Coast technical field section of its development and research division to 1150 York Rd., Abington, Pa.

New Names

Velsicol Corp., Chicago, has changed its name to Velsicol Chemical Corp. Formerly a division of Arvey Corp., it now has its own corporate structure and, accordingly, the new name has been chosen to give it a more definite description.

Worcester Forged Steel Valve Co. has changed its name to Worcester Valve Co. because it has expanded its product lines to include other than forged steel valves.

New Companies

Marlowe Chemical Co., New York, has been formed to produce and market a home-unit portable fire extinguisher.

Mineral Deposits Pty. Ltd., a new Australian subsidary of National

the News

M. A. Gibbons

Lead Co. has been formed to mine, concentrate and export rutile and ilmenite, raw materials for the production of titanium metal.

News Lines

Consolidated Vacuum Corp., Rochester, N. Y., has been licensed to manufacture and market high-vacuum molecular stills developed by Distillation Products Industries division of Eastman Kodak Co. Primarily for the laboratory, the stills provide the only known method for fractionally distilling certain raw materials without harming temperature-sensitive ingredients.

Harvey Aluminum of Torrance, Calif., has started fabricating titanium alloy extrusions on a production basis making it the first volume extruder of titanium.

Industrial Production Associated Corp., a new management and industrial engineering consulting organization, has been formed in New York.

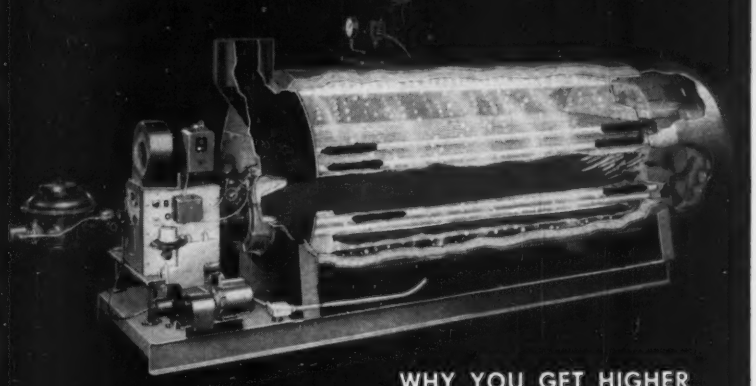
Petro Plastics Corp., Kansas City, Mo., has been formed by the French concern, LarocheFreres, to provide the U.S. market with plastic screens which are floated in storage tanks to minimize loss of volatile liquids (Chem. Eng., Aug. 1955, p. 240).

New Representatives

Vanton Pump & Equipment Corp., Hillside, N. J., has appointed Unit Process Co., Seattle, to handle sales in Idaho, Montana, Washington, Oregon and Alaska.

Emulsol Chemical Corp., Chicago, has selected Witco Chemical Co. to serve as its technical sales representative in the Cal-

FACTS ABOUT LOW COST PROCESS STEAM

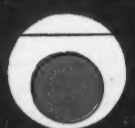


WHY YOU GET HIGHER EFFICIENCY AND CAPACITY FROM ECLIPSE SUPER-MATIC SCOTCH "STEAMBOILERPLANTS" . . .

Ordinary boiler uses additional tubes below furnace, in violation of good Scotch-Marine design.

Super-Matic, with liberal heating surface, produces rated capacity (or better) without strain under actual operating conditions.

Intense heat in small drum of ordinary "generator" strains metal.



Large Super-Matic furnace permits lower Btu per cubic foot, eliminating strain.

◀ . . . Heating surface is larger

With much greater heating surface than most packaged boilers, the Super-Matic produces rated horsepower efficiently under *normal* operating conditions, and spreads steam formation evenly. Many small 2 in. diameter tubes give you maximum heat conduction and convection. Boiler lasts a lifetime without costly maintenance.

. . . Steam space is larger ▶

Larger boiler shell, with low water line, provides large steam storage area. Hence, water line is steadier; steam is hotter and drier.

◀ . . . Combustion area is larger

Large furnace, with 300 per cent more combustion volume, permits high heat output without strain or danger of heat cracks . . . produces maximum conduction, convection, and radiation of heat to surrounding water. All heating surfaces are surrounded by water, protecting tubes from burning.

. . . Water storage is larger ▶

Larger water capacity provides "accumulator action." Greater reserve capacity eliminates fluctuations in steam pressure. Your boiler meets all peak loads easily and quickly.

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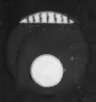
Most steam "generators" have small boiler drum, with limited steam storage space.

Large Eclipse Super-Matic drum permits ample space.



Small water capacity of most "generators" reduces reserve capacity, produces wet steam.

Large water mass of Super-Matic increases reserve capacity . . . produces hot, dry steam.

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Direct and indirect fired, for low and high pressure systems.

STRAINERS

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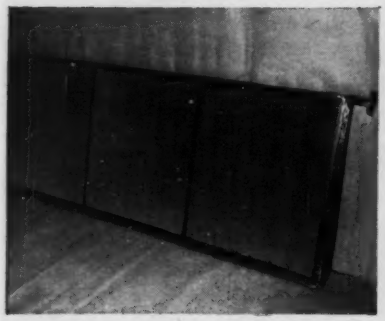

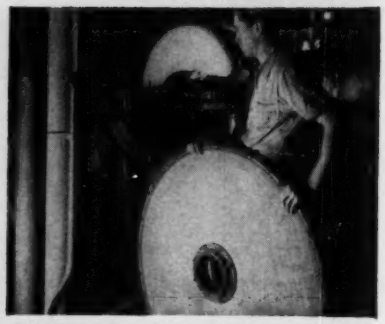

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Cambridge

FAST, ACCURATE PRODUCTION OF WIRE CLOTH PARTS

FOR FABRICATED PARTS call your Cambridge Engineers in the field, or call our home office. We'll help you select weaves, mesh sizes and metals to meet your needs and draw up prints for your OK . . . or, work from your prints. On small or large orders, you're assured of strict adherence to specifications by close manufacturing supervision.

A COMPLETE LINE of industrial wire cloth is available from Cambridge . . . specifications from the finest to the coarsest mesh in any metal or alloy. Uniform mesh size and accurate mesh count are assured by individual loom operation and careful inspection.

IF YOU BUY WIRE CLOTH IN BULK

You can get IMMEDIATE DELIVERY on large or small orders for the most frequently used types of cloth. If your needs are not in stock, we'll schedule our looms to get your material to you without delay.

LET US QUOTE on your next order for fabricated parts or wire cloth in bulk. Call your Cambridge Field Engineer—he's listed under "Wire Cloth" in your classified telephone book.

OR, WRITE DIRECT for FREE 80-page CATALOG and stock list giving full range of wire cloth available. Describes fabrication facilities and gives useful metallurgical data.

The Cambridge Wire Cloth Co.

WIRE CLOTH | METAL CONVEYOR BELTS | SPECIAL METAL FABRICATIONS

DEPARTMENT G, CAMBRIDGE 11, MARYLAND

SEE US AT CHEM SHOW — BOOTH 214

FIRMS . . .

ifornia area handling the use of surfactants in the industrial cleaning, sanitizing, petroleum and sanitation specialties field. Serving the agrichemical, food, cosmetic and mining industries will be W. G. Wunderly Co. for southern California and F. M. Speekman Co. for the northern section.

Westinghouse Electric Corp. has appointed Claude S. Gordon Co., Chicago, an exclusive distributor for standard industrial furnaces in eight midwestern states.

Research-Cottrell, Inc., Bound Brook, N. J., manufacturer of electrical precipitators for industrial gas cleaning, has appointed Sheldons Engineering Ltd., Galt, Ont., as sales representative in Canada. Equipos de Proceso, Mexico City, will represent the company in Mexico.

International Minerals & Chemical Corp. has designated John F. Young Co., Cincinnati, to handle sales of feed phosphorus, bentonite and both liquid and dry betaine in Ohio, Indiana, Michigan and eastern Kentucky and Tennessee.

W. W. Sly Mfg. Co., Cleveland, manufacturer of dust control systems, blast cleaning equipment, tumbling mills and industrial ovens, has appointed Santiago Soto Martinez of Mexico City as its engineering and service representative in Mexico.

Merck and Co. has awarded Premium Chemicals, Inc., New York, the exclusive distributorship in Long Island for its laboratory reagents and fine chemicals.

Metal & Thermit Corp., New York, has appointed eight additional metal finishing firms as franchised applicators of Unichrome 5300, a sprayable plastisol made by its United Chromi-

um Div. They are: Barber-Webb Co., Los Angeles; Crane Equipment & Supply Co., Waterbury, Conn.; Kaybar, Inc., Detroit; Lithcote Corp., Norwalk, Conn.; Metal Cladding, Inc., Buffalo; Metal Weld, Inc., Philadelphia; Paterson Rubber Co., Paterson, N. J.; Rack Processing Co., Dayton.

New Facilities

Arthur D. Little, Inc., has established a permanent operations research staff in San Francisco to be headed by Frank T. Hulswit.

Southwest Potash Corp., subsidiary of American Metal Co., plans a one-third expansion of production capacity at its potash mine and mill in Carlsbad, N. M. To cost $2.5 million, the expansion will be completed by next February.

Eleonora Chemical Corp., a newly formed subsidiary of the Pantasote Co., will complete a polyvinyl chloride plant in Passaic, N. J., in 1956. The entire production will go to Pantasote producer of coated fabrics and vinyl film and sheeting.

Noranda Mines, Ltd., is building a multi-million dollar sulfuric acid plant 20 miles east of Blind River, Ont. To be completed by July 1956, the plant will supply Algoma Uranium Mines, Ltd., and Consolidated Denison Co., Ltd., with acid for use in the production of uranium.

General Mills, Inc., has established five new district sales offices for its chemical division. Locations and office heads are: J. H. Allerdice in New York, Melvin S. Herban in Detroit; D. E. Terry in Kansas City; Melvin T. Vincent in Pittsburgh; and at Park Ridge just northwest of Chicago.

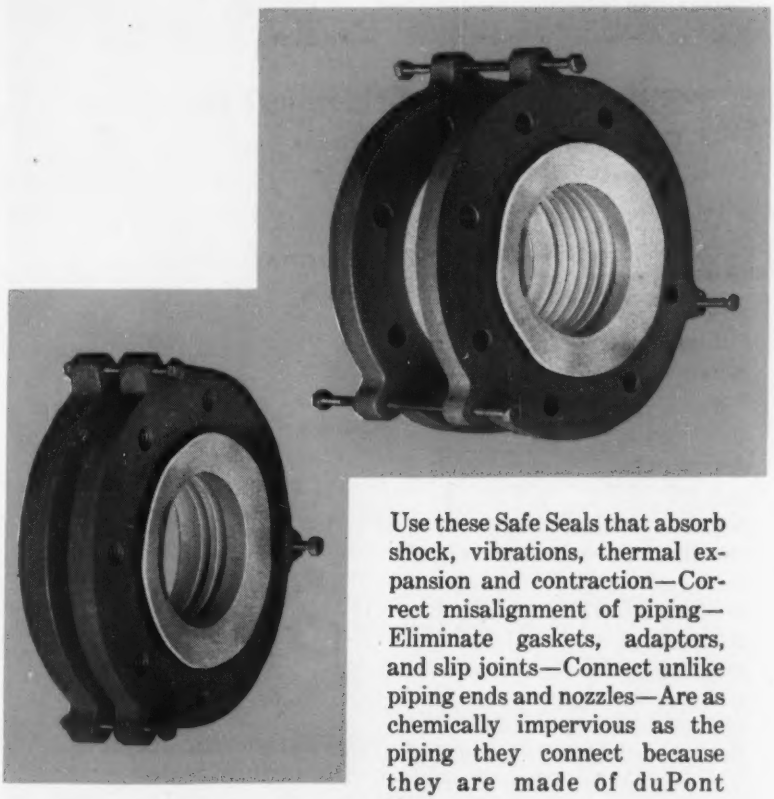
Oregon State College has $665,000 of new laboratory facilities including special provisions for

every Chemiseal Expansion Joint is pressure tested at the plant

(and Flexural Tested, too, for Special Requirements)

made of du Pont TEFLON

To be sure that Chemiseal Expansion Joints and Flexible Couplings not only protect the costly chemical piping which they connect—but will also meet the service pressure requirements of every installation with a wide margin of safety—each is individually pressure tested before leaving the plant. And for special requirements, they are flexural tested as well.



Use these Safe Seals that absorb shock, vibrations, thermal expansion and contraction—Correct misalignment of piping—Eliminate gaskets, adaptors, and slip joints—Connect unlike piping ends and nozzles—Are as chemically impervious as the piping they connect because they are made of duPont TEFLON.

Ask your Industrial Distributor or write for Bulletin FC-952.

UNITED STATES GASKET CO.
Camden 1, New Jersey

FABRICATORS OF FLUOROCARBONS AND OTHER PLASTICS

Representatives in principal cities throughout the world

visit our exhibit BOOTH 103

25th Exposition of Chemical Industries
Commercial Museum, Philadelphia
December 5-9, 1955

Complete engineering and construction services

- technical and economic studies
- engineering
- procurement
- construction
- test runs, initial operation, and training of operating personnel

A complete process equipment service

- design, engineering and fabrication of evaporators, dryers, flakers, crystallizers, mixers, impregnators, heat transfers, gas cleaners, gas absorbers
- vessels for reaction, vulcanization, distillation, solvent recovery, solvent extraction, low and high pressure processing

In all process industries

- chemicals, detergents, drugs and pharmaceuticals, fats and oils, foods, gases, low temperature, nuclear energy, petroleum, petro-chemicals, resins and plastics, rubber, synthetics and wood utilization

A single unit to a complete plant

You are welcome to discuss your process problems with our representatives

BLAW-KNOX COMPANY
Pittsburgh 22, Pa.

FIRMS . . .

work in electro-chemistry, high-pressure reactions, crushing-grinding, instrumentation and control.

Fischer & Porter Co., Hatboro, Pa., has recapitalized to provide for its newly-completed fluid mechanical laboratory and a foundry for its subsidiary, Alloy Steel Casting Co., as well as a $500,000 office building scheduled for completion next year.

General Electric Co. has opened a $300,000 radiation laboratory in Schenectady to delve further into peacetime uses of the atom.

Columbia Veneer Co. is building a $500,000 plant at Everett, Wash., to produce hardboard from cedar waste, marking the first time profitable use has been made of the material. To start operations in about a year, it will have a capacity of 75 tons a day.

Olin Mathieson Chemical Corp. has established a Canadian branch office in Montreal for its industrial chemicals division.

Dorr-Oliver Inc., by expanding its analytical, and ion-exchange testing facilities at Westport, Conn., is now equipped to handle all types of uranium extraction studies. Small quantities of uranium can be processed through all stages from the raw ore to the yellow cake. In addition, the company has acquired marketing rights to two gold and silver recovery processes: the Merrill-Crowe cyanide precipitation process and the Mills-Crowe cyanide regeneration process.

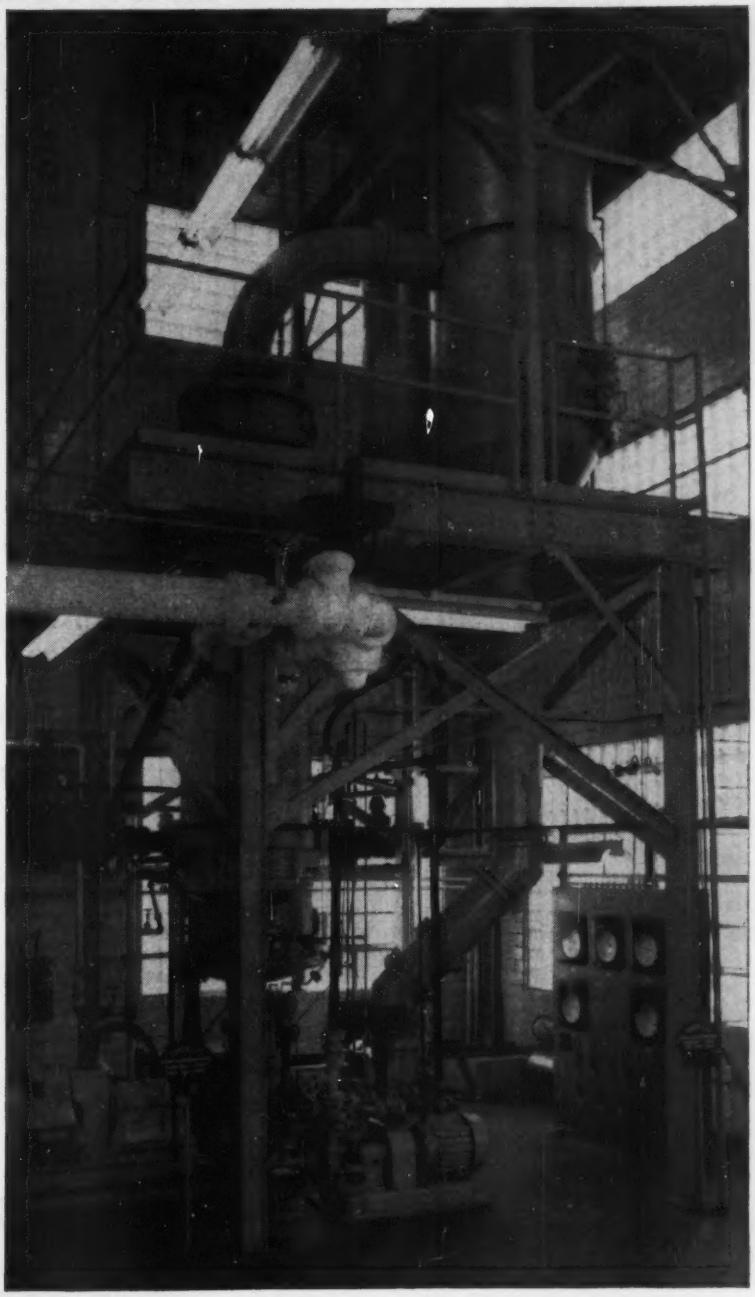
Glidden Co. plans a $500,000 expansion of its naval stores division plant in Jacksonville, Fla., to permit a 25% increase in the production of natural and synthetic terpene chemicals.

Industrias Quimicas de Mexico, S. A., subsidiary of Stauffer Chemical Co., will construct a

Buflovak Single-Effect Evaporator helps Huron Milling concentrate a *highly corrosive* protein solution

The problem faced by The Huron Milling Company, Harbor Beach, Michigan, in the production of Huron MSG (Monosodium Glutamate), was the concentration of a highly corrosive solution of vegetable proteins that have been hydrolyzed in HCl. The solution to the problem was the use of a Buflovak Single-Effect, forced circulation evaporator, of completely acid resistant construction. The heat exchanger is constructed with rubber lined steel heads, Haveg tube sheets and Karbate tubes. The same general scheme of construction was applied to the condensing equipment. Rubber lined steel is used in the construction of the flash chamber and all of the product piping is fabricated from rubber lined steel, Haveg and Pyrex. Buflovak's solution to this problem included instrumentation for automatic operation of the evaporator.

The Huron Milling problem is just another case for Blaw-Knox Engineers, who regularly help manufacturers in many fields to solve their processing problems. Perhaps they can help you, too, by recommending proper equipment for your process, whether it is for introduction of a new product or for improvement of an old one. Why not write us today?



A complete process equipment service

Concentration of heat sensitive products is but one phase of Blaw-Knox Process Equipment design, engineering and fabrication service for the chemical, food, pharmaceutical, plastic and resin, petroleum, rubber and other industries:

EVAPORATION • DRYING • FLAKING
MIXING • IMPREGNATING • REACTION
VULCANIZING • CRYSTALLIZATION
DISTILLATION • SOLVENT RECOVERY
SOLVENT EXTRACTION • GAS CLEANING
GAS ABSORPTION • POLYMERIZATION
VAPORIZATION • CONDENSATION
HEAT TRANSFER • STERILIZING
LOW AND HIGH PRESSURE PROCESSING

See Our Exhibit in Booth 103
25th Exposition of Chemical Industries
Commercial Museum, Philadelphia
December 5-9, 1955

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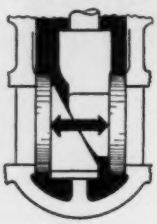
BUFLOVAK EQUIPMENT DIVISION
1551 Fillmore Avenue, Buffalo 11, N. Y.

LESS MAINTENANCE

- Fully revolving discs
- Uniform wear distribution
- Equalized wedging pressure
- Automatic adjustment for body distortion
- Positive closing



. . . with Darling gate valves on the job!

DARLING *fully revolving double disc parallel seat* gate valves don't need maintenance as often as other valves.

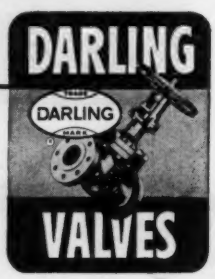
This exclusive Darling design eliminates valve leakage and faulty operation . . . due to body distortion and man-handling. You can always count on Darlings to close easier, to close tight, and to serve longer without attention.

Available in iron body, cast steel, iron body rubber lined, all bronze and special alloys . . . for all kinds of ordinary and special services.

Made with the kind of ends needed for your particular installations. Write for complete information.

DARLING VALVE & MANUFACTURING CO.
Williamsport 3, Pa.

Manufactured in Canada by
Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.



FIRMS . . .

100-ton-a-day sulfuric acid plant in the State of Michoacan, Mexico.

Esso, A. G., West German subsidiary of Standard Oil of New Jersey, plans to build a new 3 million-ton-a-year oil refinery ether in the Hamburg area or the Rhine-Ruhr district.

Cities Service Oil Co. will spend $5 million next year on new construction and enlarging of its Ponca City, Okla, refinery.

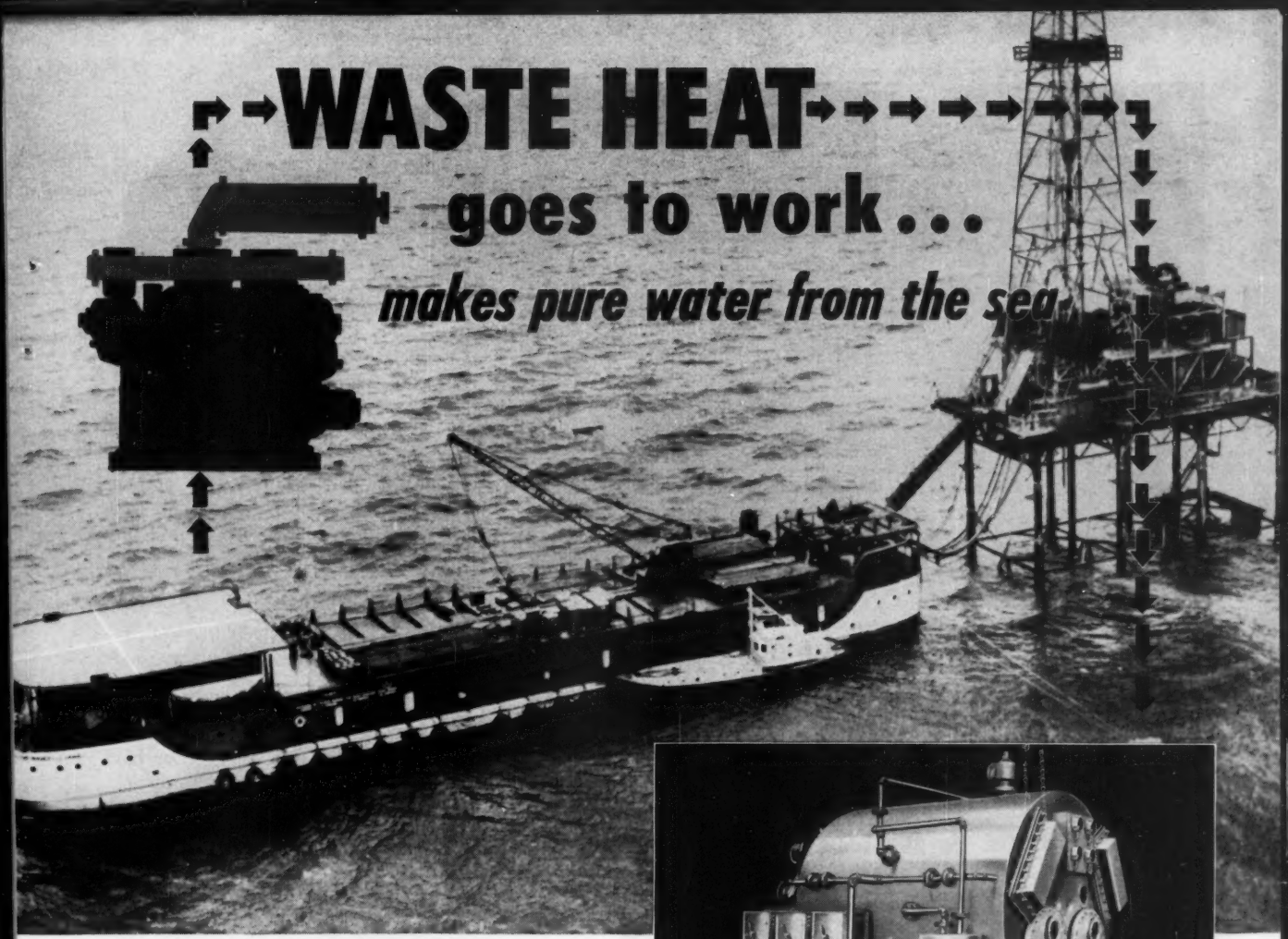
Brin Chemical Corp. is building a $100,000 installation in Tulsa, Okla., to manufacture phenol, zylenol, cresylic acid and various fractions of these chemicals.

Wyandotte Chemicals Corp. has formed three new divisions: the Michigan alkali division to be made of the former Michigan alkali sales and manufacturing divisions; the research and engineering division to encompass research activities, engineering, production research and new business development departments; the general products division including purchasing, traffic, non-chemical sales and manufacturing operations.

Owens-Illinois Glass Co. has dedicated a new technical center in Toledo which will house studies of glass from theoretical research to tests under actual commercial conditions.

Roger Williams Technical & Economic Services, New York, has just acquired property in the Princeton, N. J., area for the construction of new executive offices.

Olin Mathieson Chemical Corp. has just completed a plant near Pittsburgh for the formulation, packaging and distribution of automotive anti-freeze and related products. Olin-Mathieson is also expanding its operations in the Mediterranean area through the former E. R. Squibb



CATC and Cleaver-Brooks join to make history with potable water at zero cost

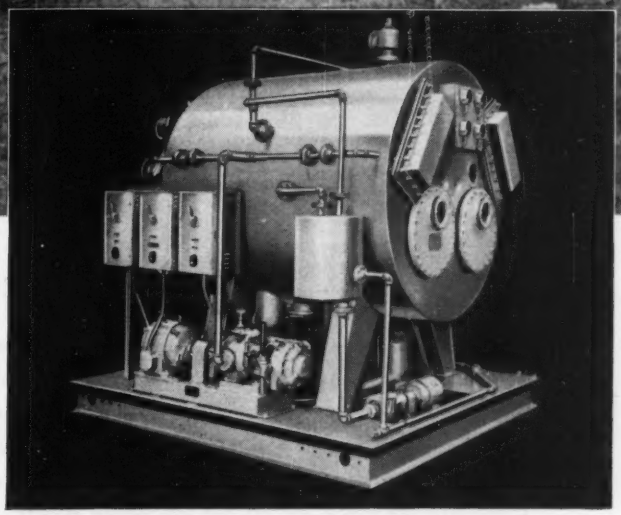
Diesel engine cooling water need no longer be wasted. It can go to work as a *valuable tool, producing low-cost pure water!* This was demonstrated recently with the launching and christening of the CATC's off-shore drilling tender, *Jack Cleverley* at the Levingston Shipbuilding Company, Orange, Texas.

This installation represents *the most modern Waste Heat Evaporator in this area of operations.* It is the ultimate in design for this type of service.

Cleaver-Brooks Company is proud to have been part of this event. We salute the CATC Group, including Continental Oil Company, Atlantic Refining Company, Tide Water Associated Oil Company, Cities Service Company and the Levingston Shipbuilding Company.

Cleaver Brooks

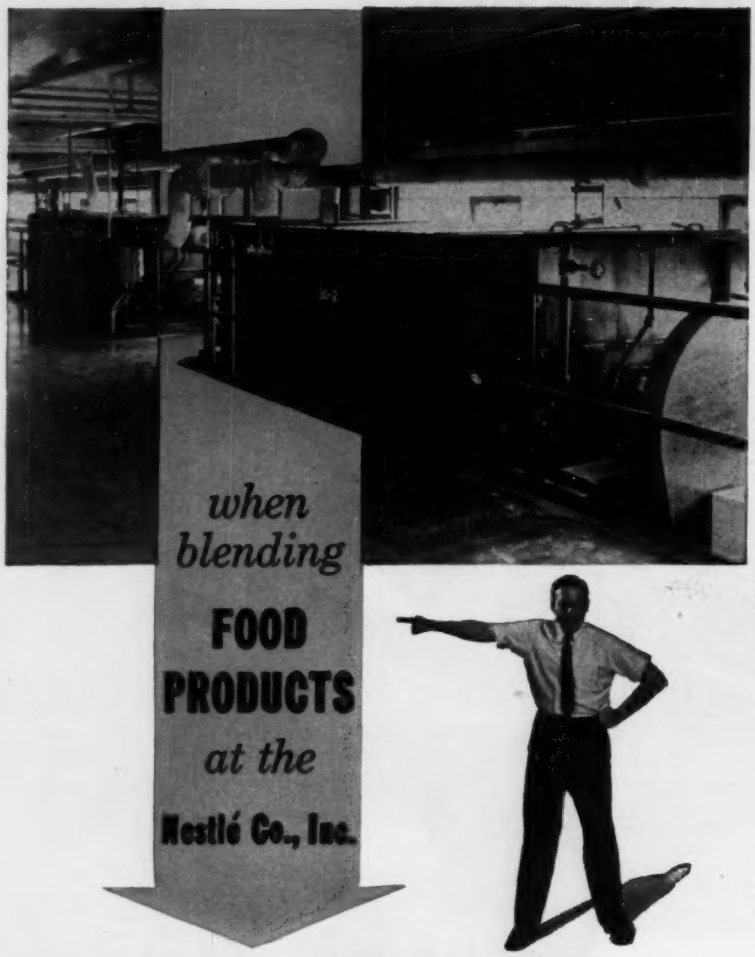
BUILDERS OF EQUIPMENT FOR THE GENERATION OF HEAT AND POWER



Cleaver-Brooks Waste Heat Evaporators are particularly adaptable to off-shore drilling platforms, tenders and diesel barges

Practically no scale removal. Potable water is produced from the sea at zero cost because unit uses waste heat from rig's diesel engines . . . transmitting it through heat exchangers charged with sea water. Hot water flashed into a vacuum chamber is partially converted into steam, which is then condensed on cooling coils for the output of distilled water for "mud" make-up, drinking, etc. Unit above has a capacity of 300 gph — similar units can be built to match actual water needs.

For complete details on Waste, Heat, Flash Type, Vapor Compression and Low-Pressure Steam Evaporators — for any pure water need — write: CLEAVER-BROOKS COMPANY, Dept. M, Special Products Division, 365 E. Keefe Ave., Milwaukee 12, Wis., U.S.A. Cable Address: CLEBRO-Milwaukee — all codes.



DAY JUMBO MIXERS . . . meet every requirement for maintaining a thorough blend of chocolate products under sanitary conditions at The Nestlé Company, Inc., Fulton, N. Y. For instance: seals may be furnished of sanitary construction requiring no packing, and of such simple design as to permit thorough cleaning in a matter of minutes between batches—(no more black specks working into product from stuffing boxes).

Outboard bearings on all models allow plenty of room for normal cleaning and maintenance. Special agitators available for blending high shortening content products. Heating or cooling jackets, dust covers and many other optional features available. For complete information write for Bulletin 800.

FOUNDED 1887

in mixing equipment **DAY** *means longer life span*

THE J. H. DAY COMPANY
INCORPORATED
4932 BEECH ST., NORWOOD, CINCINNATI 12, OHIO
Division of Cleveland Automatic Machine Company

Quality equipment for baking, paint and varnish, printing ink, chemical, rubber, pharmaceutical, cosmetics, paper and pulp, explosives, food, ceramics, candy, soap, sugar and milk products.

Eastern Canada: Brantford Oven & Rack Co., Ltd., Brantford, Ontario
Western Canada: British Canadian Importers, Vancouver, British Columbia
Mexico: T. de la Pena e Hijos, S.A., Nazas 45-A, Mexico 5—D.F.

FIRMS . . .

& Sons division affiliate in Italy. The U. S. government has guaranteed its earnings and royalties will be convertible into dollars and has also guaranteed it against expropriation.

Delta Tank Mfg. Corp. has placed in operation a 75-ft. gas fired, stress-relieving furnace at its Baton Rouge, La., plant. It is expected to produce higher quality pressure vessels and a wider range of products for the chemical and petroleum industries.

Royal Dutch-Shell has started production of epichlorhydrin at Pernis, Holland, the first time the chemical has been manufactured outside the U.S.

American Hard Rubber Co. has acquired Industrial Synthetics Corp. of Garfield, N. J., and its subsidiary, Supplex Corp. Both firms make plastic lawn sprinklers and garden hose.

National Bureau of Standards has established a new radiochemistry laboratory for use in preparing and distributing standard samples of radio-active materials.

Canadian Forest Products of British Columbia is spending more than $1.3 million to expand its Port Mellon pulp mill on Howe Sound. Among the major new facilities will be a boiler shop and black liquor recovery furnace.

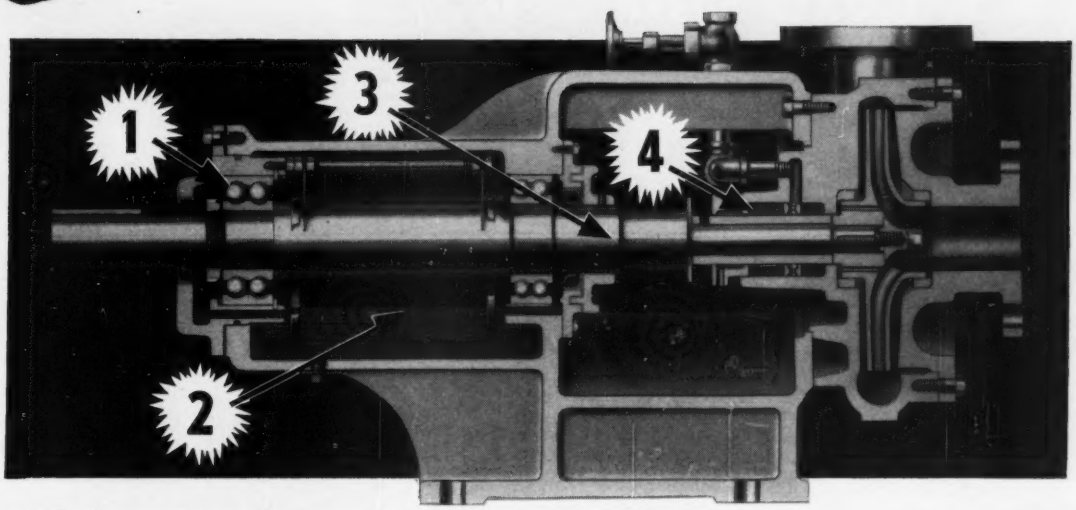
California Spray-Chemical Corp. is about to complete a new wing on its administration building at Richmond, Calif., which will provide 8,000 sq. ft. of additional office space.

Marquette Cement Mfg. Co. plans a $16 million expansion program to add nearly three million barrels to its yearly production capacity.

Holiday Plastics Inc., plastics fabricator of Kansas City, Mo., has acquired the Thermacote

ALLIS-CHALMERS
Oil-Lubricated
Chemical
PUMP

4 Check these Quality Spots



Cut Maintenance Costs and You Cut Pump Costs!

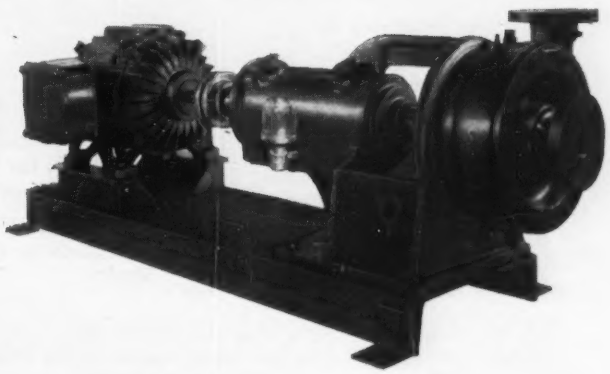
Here's an "all-around" pump designed for your industry. It costs hundreds of dollars less than refinery pumps — yet does many of the same jobs. It costs a little more than grease-lubricated pumps — yet more than makes up the difference by cutting maintenance.

It's a quality pump throughout. As shown above, it has:

1. Double-row oil-lubricated bearings with positive end closures suitable where acid or alkali vapor or abrasive dust is present.

2. Oil lubrication — which does away with the most common cause of bearing failure — overgreasing. Oil lubrication also permits operation at higher temperatures.

3. Heavy shaft — holds alignment, reduces wear of parts. Either high grade carbon steel or stainless steel is provided, depending on application. Pump can be supplied with or without shaft sleeve as desired.



4. Alternate sealing arrangements — Any one of six different sealing arrangements can be provided, including a water-cooled stuffing box where the liquid being pumped is above 250 F.

Allis-Chalmers builds many types of pumps, but this particular type is recommended for pumping liquors, corrosive materials and solutions in the most used ratings to 3500 gpm, heads to 400 feet for liquids to 550 F.

A-4870

For complete information call your nearby A-C office or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin, for Bulletin 52B7638.

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THE ONLY 90% METALLIC LEAD ALL-PURPOSE THREAD COMPOUND
Dragert's
with SILICONES added
...QUICKLY PROVES WHY

THIS MIRACLE
THREAD COMPOUND
IS
12-WAYS BETTER

1. Fewer Dopings Required
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3. Quicker, Easier Break-Outs
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5. Universally Adaptable to Water, Oil and Chemical Lines
6. Unexcelled Lubrication
7. Longer Thread Life
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10. Chemically Impervious
11. Island-High Lead-Plating of Threads for Unsurpassed Protection
12. Equally Effective on Half-Inch Studs or Propeller Shafts

Big "D" Thread Dope (90% atomized metallic lead, 10% vehicle, with wonder Silicones added for plus performance) excells wherever thread compound is required. Absolute satisfaction guaranteed or your money cheerfully refunded. Having supplied industry efficiently for 25 years, we will be delighted to serve you, too.

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SOLD ON MONEY-BACK GUARANTEE!!

FIRMS . . .

Plastic Products Corp. of Newark, N. J., and is now in a position to triple its production.

J. M. Huber has opened a new ink plant adjacent to its clay division operations at Huber, Ga.

Scott Paper Co. will expand its Mobile, Ala., plant to accommodate production of 120 additional tons of bleached pulp per day.

R. M. Hollingshead Corp. has started operations at its new $1 million manufacturing and distribution center at Sunnyvale, Calif. It is equipped to turn out 1.5 million gallons of maintenance chemical compounds annually.

Shell Oil Co. has placed in operation a specially-built barge designed to haul asphalt in hot liquid form from Portland, Ore., terminal up the Columbia River to storage and blending facilities at Pasco, Wash.

Continental Oil Co. will install a 1,500-bbl.-a-day catalytic reforming unit at its Artesia, N. M., refinery as part of a new $500,000 modernization program.

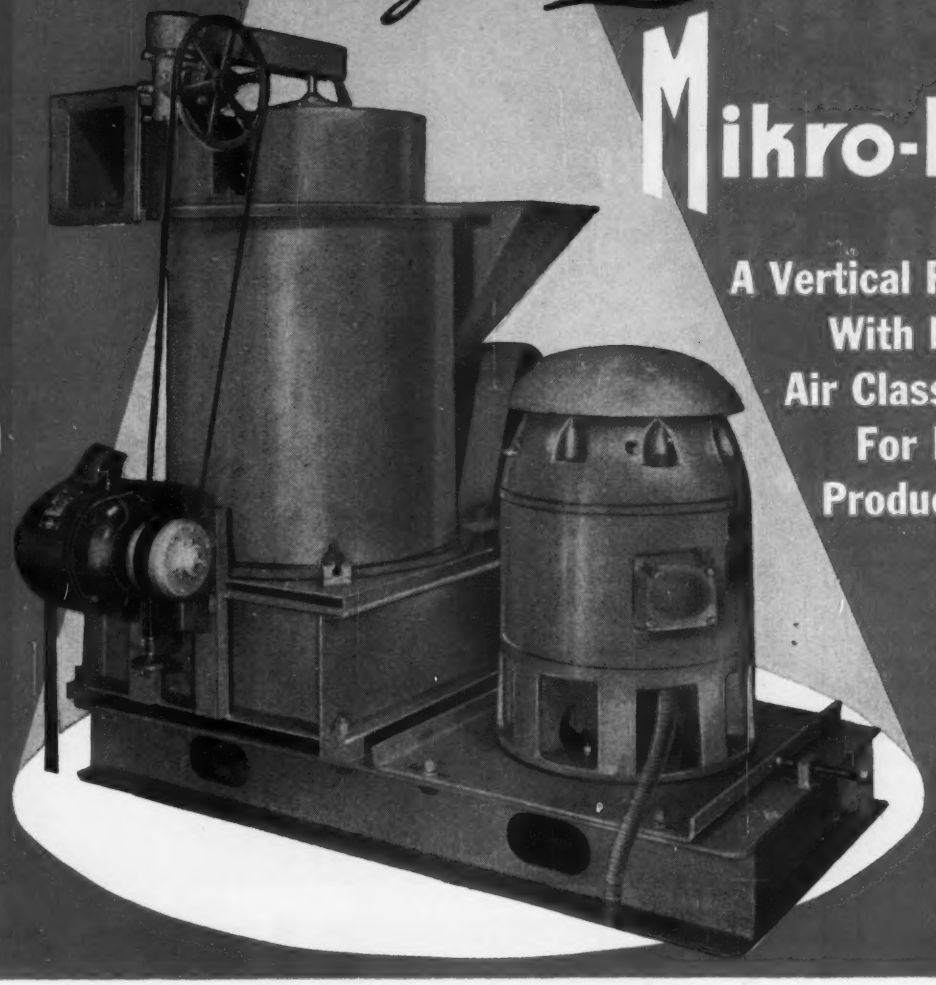
W. R. Grace & Co. has announced that its Davison Chemical Co. division and Rare Earths, Inc., a wholly owned subsidiary, have joined in a program of expanded production, sales, research and development of rare earths and thorium.

Norton Co., Worcester, has started construction of a plant in Huntsville, Ala., to manufacture fused magnesia, fused zirconia, boron carbide and special materials for the AEC.

General Mills, Inc. will begin expansion of its research facilities to a campus-like setting on the outskirts of Minneapolis in 1956.

Introducing the New

Mikro-BuD



A Vertical Pulverizer With Built-In Air Classifier For Increased Production

SEND FOR— your copy of new MIKRO-BuD Bulletin and Test Grinding Data Sheet

See the new MIKRO-BuD at the MIKRO Exhibit Booth C-30 Chemical Industries Exposition Philadelphia, Pa., Dec. 5-9

This new mill, with its instant ability to shift from one particle size to another in grinding operations, is rolling up impressive performance records. By the simple turning of a small hand-wheel the mill can be quickly adjusted over the entire range of its particle size potential in a matter of seconds.

The unit, which comes in two sizes (50 hp. and 5 hp.), has been designed to produce an intermediate fine grind at high capacities. Its power economies, quick cleanability and cool grinding are features which have caused its use to be carefully investigated by discriminating buyers seeking the improved production output which it makes possible.

The MIKRO-BUD will handle a comprehensive range of dry materials for a considerable number of uses in the chemical, food, pharmaceutical, drug, cosmetic, plastic and allied industries. A test of your material on this new unit in the MIKRO Laboratory may supply the answer to increasing your pulverizing production.

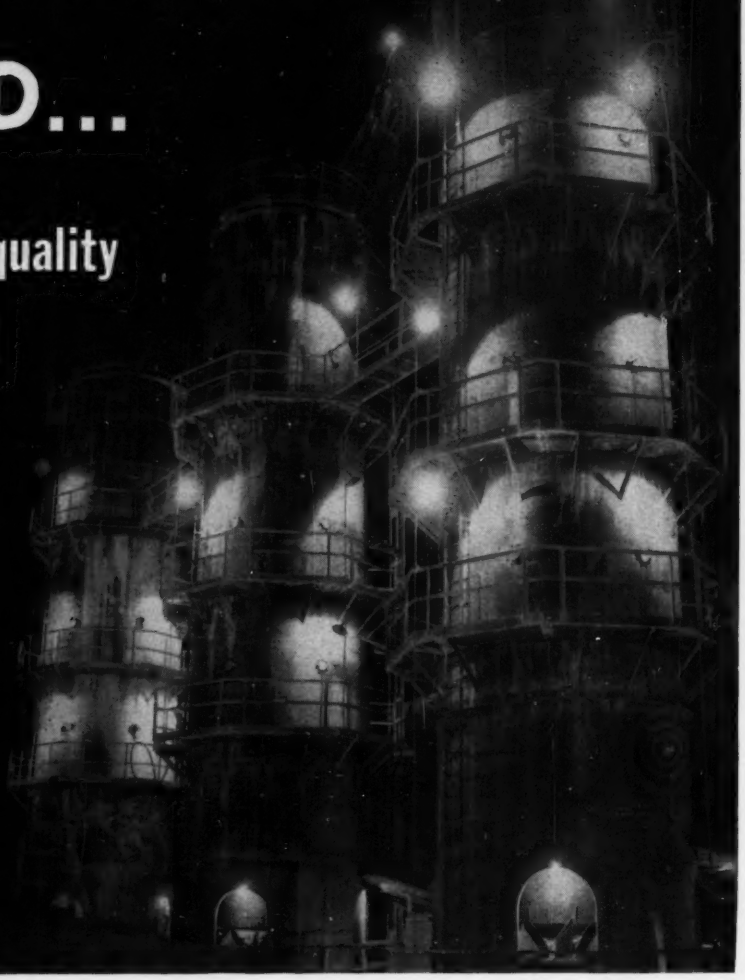
Mikro-BuD

PULVERIZING MACHINERY DIVISION
METALS DISINTEGRATING COMPANY, INC.
97 CHATHAM ROAD **SUMMIT, NEW JERSEY**

PULVERIZING • AIR CONVEYING • DUST COLLECTING EQUIPMENT

WEST END...

'round the clock source of finest quality SODA ASH



Giant kilns burn lime and coke to make carbon dioxide. This gas is used to separate the soda ash base from the brine that is pumped in from the natural deposits of Searles Lake in the California desert. The burned lime by-product is conveyed to a special plant where it is processed into hydrated lime—another product of West End Chemical Company.

The manufacturing, storage and shipping facilities of West End are constantly at work for western industry. This continuous operation provides ample soda ash to supply both immediate requirements and maintain a vast reserve. Regardless of market conditions, West End meets all normal and emergency needs of western industry promptly. Strategic location of plant permits fast, economical transport by rail or truck to any point in the West.

Write for samples, prices and technical data.

WEST END CHEMICAL COMPANY

SODA ASH • BORAX • SODIUM SULFATE
SALT CAKE • HYDRATED LIME

PERSONAL SERVICE — Customers anywhere in the West are only a few hours away by company plane.

IMMEDIATE SHIPMENT to customers throughout the West in company's own leased hopper cars . . . ready at all times.

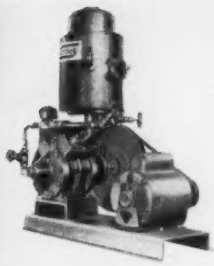
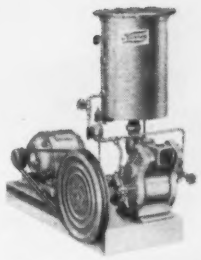
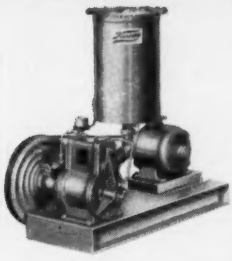
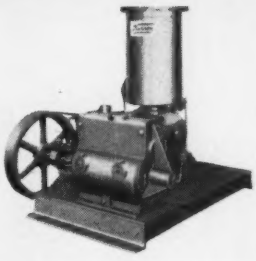
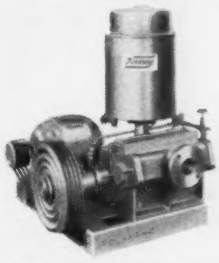
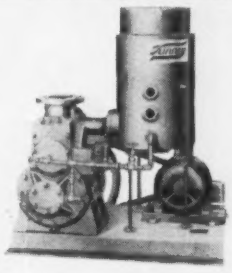
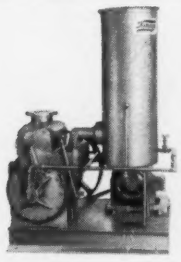
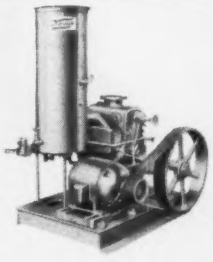
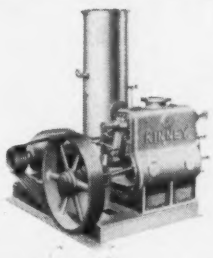
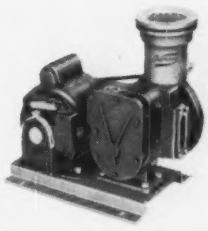
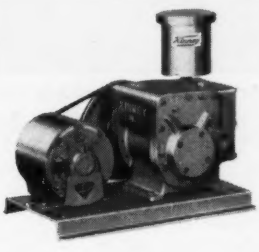
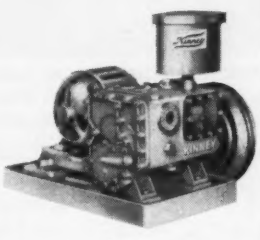
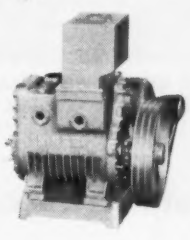
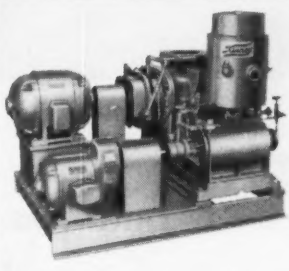
30 MINUTE IN-AND-OUT LOADING for bulk trucks at any hour of day or night through "serve yourself" delivery.

West End Chemical Co.

Executive Offices: Nineteen Fifty-Six Webster Bldg., Oakland 12, California · Plant: Westend, California

Kinney

HIGH VACUUM PUMPS

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Please send Catalogue 425 describing the complete line of Kinney High Vacuum Pumps.

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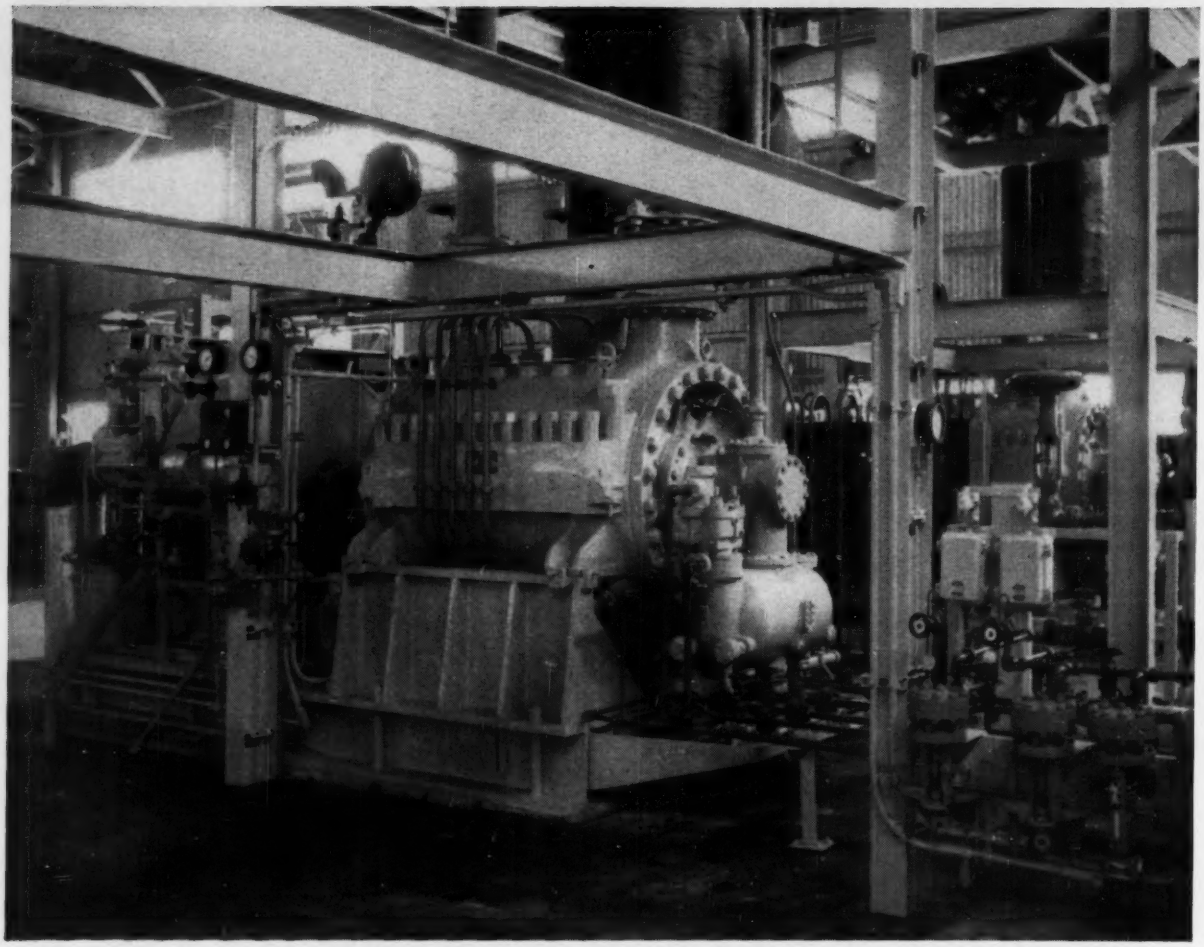


ONE OF TWO WORTHINGTON CENTRIFUGAL COMPRESSORS keeping the temperature — and cost — *low* in ammonia processing at Lion Oil Company's plant. This unit cools a copper solution used to scrub NH_3; and chill and condense the compressed NH_3 gas to a liquid state.

Ammonia gets low-cost scrubbing and chilling with Worthington compressors

Every day 20 million cubic feet of natural gas are used in producing 300 tons of anhydrous ammonia at Lion Oil Company's Barton Plant in Luling, Louisiana — and nothing goes to waste!

Part of the credit for this efficient operation goes to two new Worthington centrifugal compressors which chill and scrub ammonia gas during the synthetic process. Unlike ordinary compressors, the new Worthington units employ interstage liquid ammonia injection — an exclusive feature that effectively reduces the heat of compression and thereby more efficiently converts velocity energy into pressure.

Choice of the Worthington compressors was based largely on this efficient design which has already introduced new economies into the Barton Plant operation. The centrifugal units, each rated at more than 1300 tons capacity, are powered by reliable Worthington steam turbines.

Worthington centrifugal compressors may be the answer to low-cost, high-volume processing in your plant, too. Find out how these units put big chilling jobs on a more profitable basis by writing Worthington Corporation, Air Conditioning & Refrigeration Division, Section A.5.61-CG, Harrison, N.J. A.5.61

WORTHINGTON

CLIMATE ENGINEERS TO INDUSTRY, BUSINESS AND THE HOME

where throttled steam is a

valve killing "vapor drill"

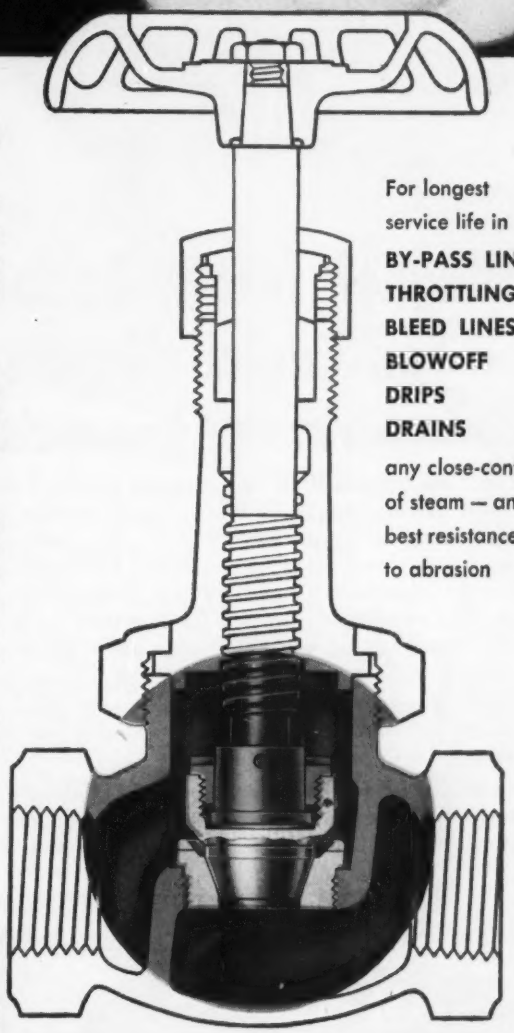
JENKINS PLUG TYPE VALVES

with the

500 BRINELL

STAINLESS STEEL ARMOR SEAT

will lower costs



Closely regulated steam erodes grooves in seating units and drastically cuts service life of ordinary valves.

Jenkins Plug Type Valves have been engineered in every detail for maximum wear in such valve-killing service. The stainless steel Armor Seat defies the "vapor drill", and Jenkins quality throughout gives them top rating for wear-proof and trouble-proof perfomance.

Make you own test . . . in your toughest steam service . . . or anywhere that abrasion or erosion causes frequent valve failure. Compare, part for part, with any similar valve. You'll find that, again, Jenkins *extra value* pays off in longer life and lower maintenance cost.

Plug and seat ring are Jenkins JX500, a Stainless chromium alloy steel made to Jenkins high strength specifications, heat-treated to 500 Brinell. Seating surfaces are super-hard and mirror-smooth, offer highest resistance to galling, cutting, abrasion, and erosion. Wide, steep, 30° total taper permits extremely close regulation of flow and vapor-tight closure.

The Stainless steel plug is securely fastened to the spindle with a bronze locknut. Spindle is aluminum bronze with a tensile strength exceeding 70,000 lbs., — has high corrosion resistance.

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BY-PASS LINES
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BLEED LINES
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any close-control of steam — and for best resistance to abrasion

300 lb. 200 lb. 150 lb.
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ELECTRIC MOTORS
...the choice of leaders in industry

New NEMA Frames
Standard and Explosion-proof

Type EP
215 Frame

Wagner Totally-Enclosed Fan-Cooled Motors

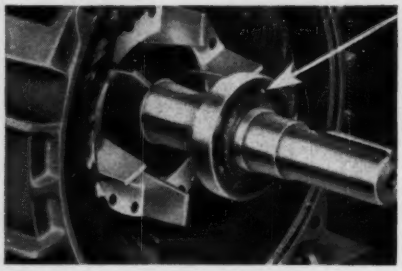
cut maintenance time and costs

Check the features of the new *Wagner Type EP Totally Enclosed Motor*. They spell the difference between needless expenditures in maintenance time and costs . . . and a definite savings in motor upkeep and repairs. You'll find that for general industrial use where dust, dirt, filings, abrasives, steel chips or moisture are present, the Wagner Type EP Motor gives steady, troublefree performance and longer service life.

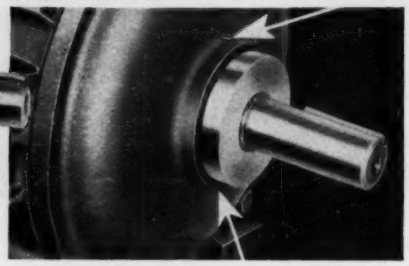
Wagner Type JP Explosion-Proof Motor . . . has the same quality construction as the Type EP – plus added features which make it completely safe to operate where explosive dust, gases or vapors are present.

Both Type EP and JP Wagner motors are available in ratings up to 250 horsepower. For complete information, just call the nearest of our 32 branch offices, or write for Bulletin MU-203.

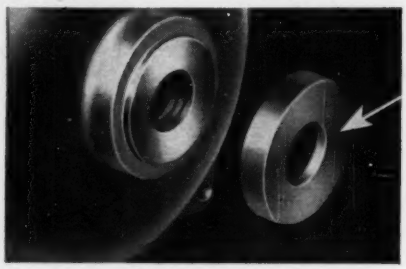
Wagner Electric Corporation
6400 Plymouth Ave., St. Louis 14, Mo.



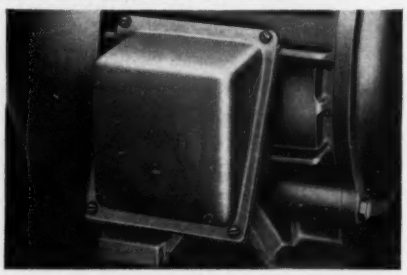
1 HEAVY-DUTY BALL BEARINGS—Highest quality bearings of more than ample capacity provide long, troublefree service.



2 BEARINGS CAN BE RE-LUBRICATED—Wagner motors can be re-lubricated when necessary to prolong bearing life.



3 BEARINGS STAY CLEAN—Both ends of these motors are equipped with running shaft seals, a machined collar mounted on the motor shaft.



4 EASY TO CONNECT—Large diagonally-split conduit box provides ample room for making connections. Leads are permanently identified.

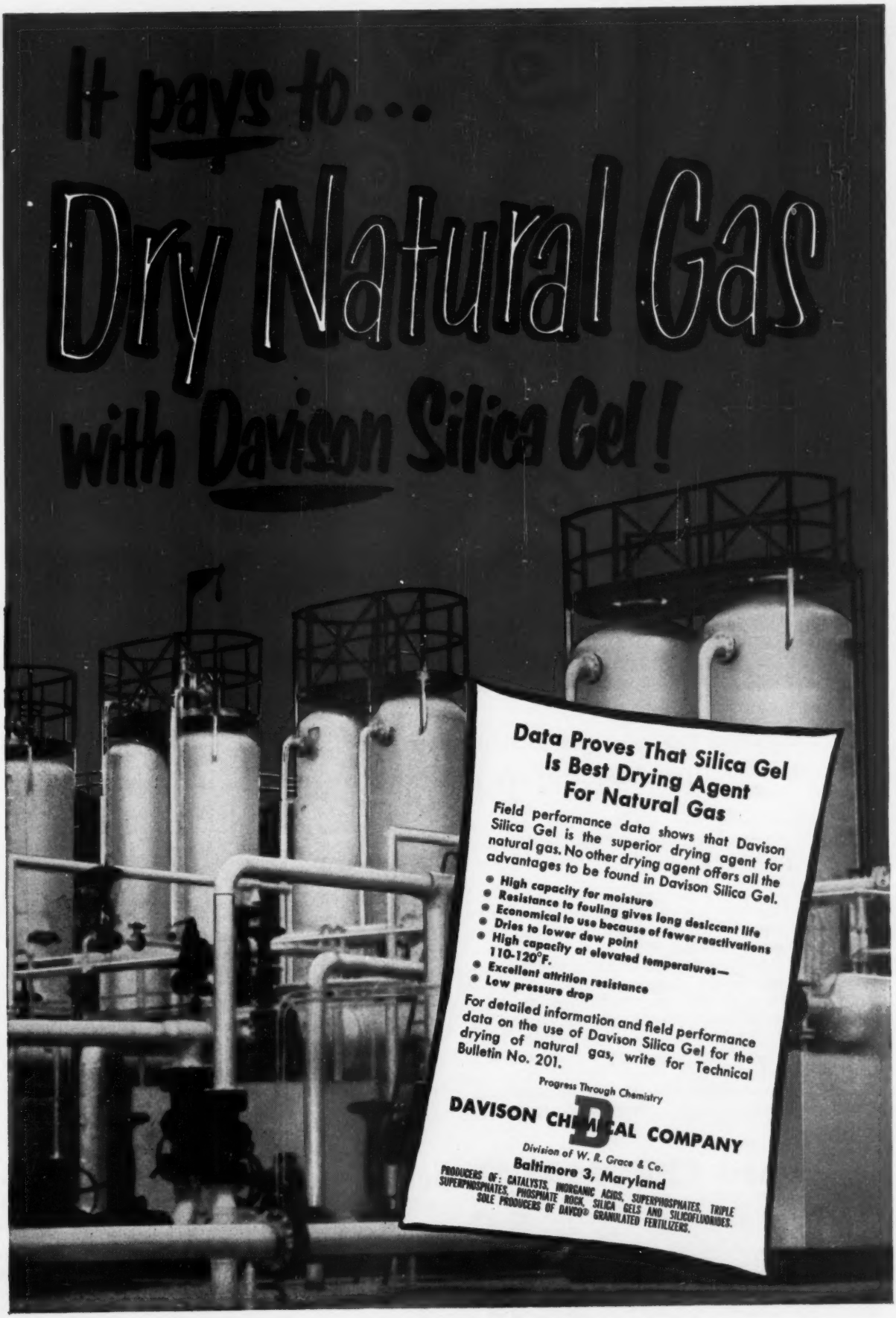
5 NO GREASE LOSS—Bearing housings have effective seals to prevent escape of grease.

6 RIBBED FRAME—Ribs on the corrosion-resistant cast iron frames add mechanical strength and increase the surface area for more efficient cooling.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

H55-18

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS-AIR AND HYDRAULIC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Dry Natural Gas
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Data Proves That Silica Gel Is Best Drying Agent For Natural Gas
Field performance data shows that Davison Silica Gel is the superior drying agent for natural gas. No other drying agent offers all the advantages to be found in Davison Silica Gel.
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For detailed information and field performance data on the use of Davison Silica Gel for the drying of natural gas, write for Technical Bulletin No. 201.
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heating corrosive solutions electrically insures clean, precise heat in plating plant

To heat corrosive solutions used in various plating operations—yet have absolute cleanliness in the plating area—was the problem faced by the Kearfott Company, Inc., Little Falls, N.J.

Eleven Chromalox electric immersion heaters provided the answer to this company's nickel; copper and chrome plating; hard and soft anodizing; dichromate and oxide coatings; and electropolishing operations.

Extremely important was the selection of immersion heaters with the correct stainless steel, lead or other sheath material to assure long, trouble-free life of the heaters in the various corrosive chemical solutions. These solutions, for example, include phosphoric acid, oxalic acid, chromic acid, nickel sulphate chloride and copper sulphate.

Results are maintenance of precise temperature in each tank . . . Long heater life . . . Spotless plating area . . . Better, cleaner and more economical plating operations.

This problem-solution-result approach has enabled us to help many manufacturers produce better, faster, at lower cost.

Always available to you are our research, engineering, design and modern manufacturing facilities. The world's largest factory stock of industrial electric heaters plus local stocks at strategic points. And a 33-city nation-wide sales-engineering service.

Let us know your problem for controlled heat and we'll help you find the right answer—electrically.

To get further information about Chromalox Electric Heaters for the electroplating industry, write for Bulletin No. 750.

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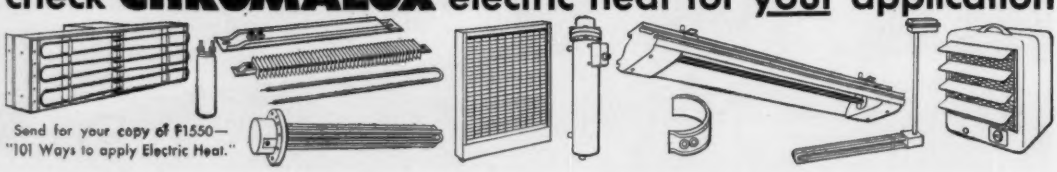
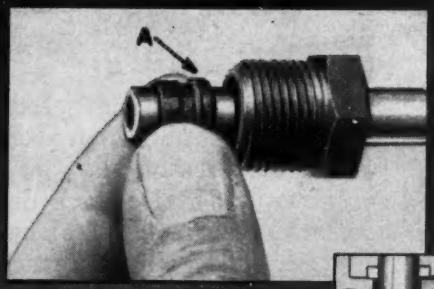
check CHROMALOX electric heat for your application

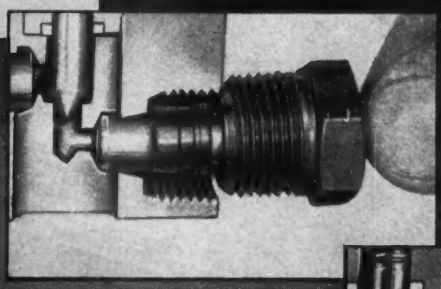


Send for your copy of F1550—
"101 Ways to apply Electric Heat."

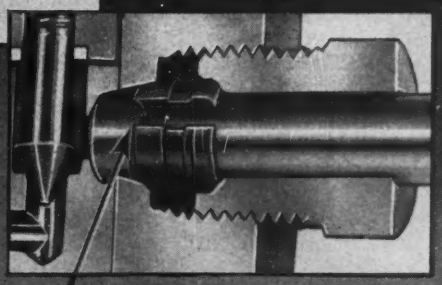
You Can Install This Valve In 3 EASY STEPS



Step 1. Slip the adapter nut and then sleeve over end of tubing. Be sure head of sleeve (A) is toward nut as shown.



Step 2. Insert tubing into valve as far as it will go.

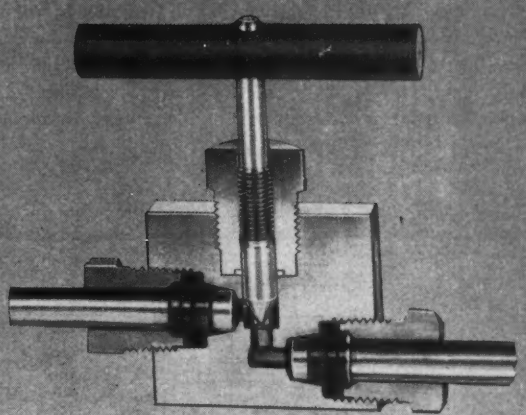


Step 3. Tighten adapter nut. Note how sleeve (cut away for clearer view) grips tubing insuring a gas-tight seal.

© TUBE LINE VALVES

Tube Line Valves up to 4000 p.s.i. eliminate pipe threading . . . seal welding . . . and every joint is a union.

Made to the same high standards of quality and precision craftsmanship which characterize high pressure equipment for pilot plant and laboratory . . . yet TUBE LINE valves work better and cost no more than conventional screw-end valves. Their easy and fast assembly in the lines have won preference for TUBE LINE valves in many diverse industries. Full details are yours in Bulletin 255—write for it.



TUBE LINE

AUTOCLAVE ENGINEERS, INC.

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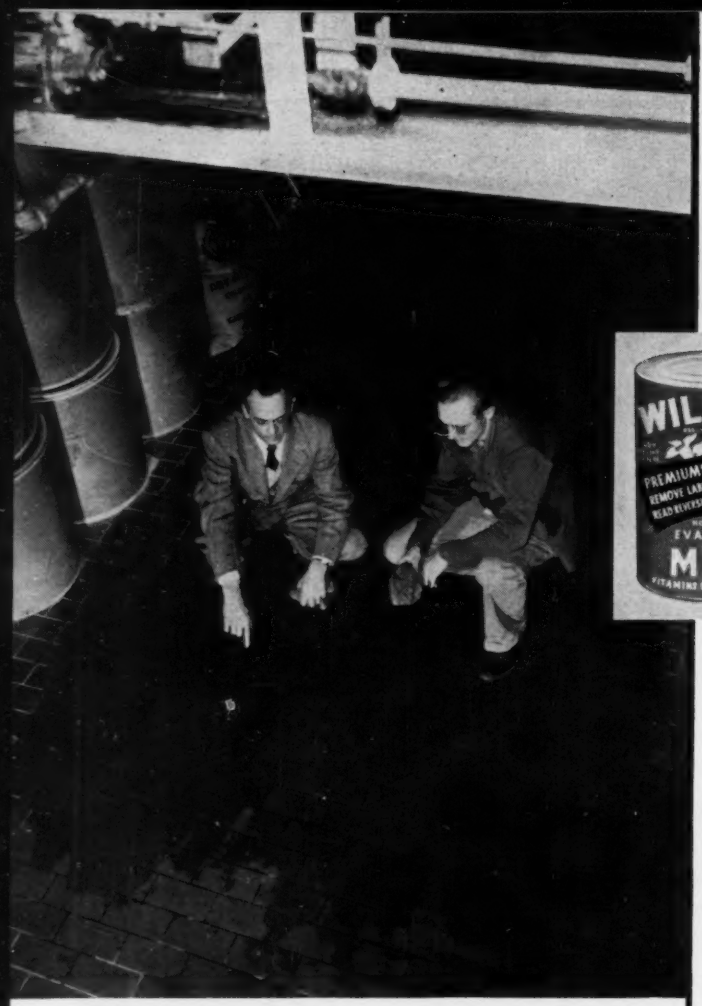
STANODRIP *Oil whips lubrication problem at Wilson Milk Company*



Taylor Wiham, Wilson Milk Company (right), and John Pirtle, Standard Oil lubrication specialist, inspect oil stain on otherwise spotless floor, the result of previous oil leakage from overhead hydraulic bin loader. Leakage has been eliminated through use of STANODRIP Oil No. 29. Helping customers with lubrication problems is something John Pirtle is well equipped for. John has an engineering degree from Rose Polytechnic Institute, has completed Standard Sales Engineering School and has a number of years of field technical service experience. Customers find this experience and training pay off for them.

MANAGEMENT OF THE Wilson Milk Company plant, Sheridan, Indiana, had a serious lubrication problem. STANODRIP Oil solved it.

In overhead bin loaders, hydraulic rams push powdered milk along conveyor chute to weighing machine. Leakage of lubricant from rams on the floor below caused a sanitary and safety problem. Packings were replaced every two months but leakage often recurred as early as two weeks after packing replacement.

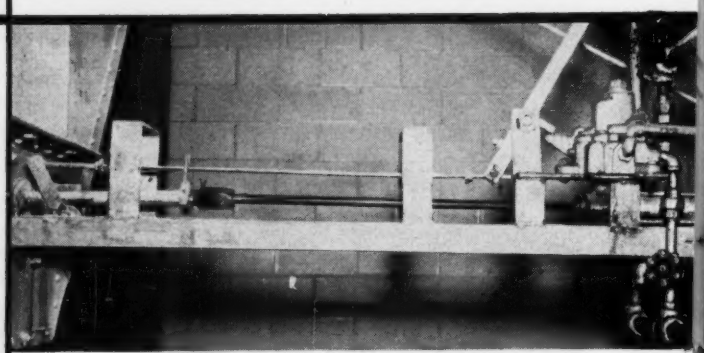
Then Mr. Taylor Wiham, Assistant Superintendent, called in John Pirtle, Standard Oil Industrial lubrication specialist. Mr. Wiham asked about STANODRIP Oil and its possible use as a solution to this lubrication problem. Decision was made to convert to STANODRIP Oil No. 29. Old oil was removed, packings replaced and STANODRIP installed.

In more than 8 months since installation of STANODRIP Oil, there has been no leakage, no packing replacement. Hydraulic rams are lubricated without oil dripping or creeping.

Maybe STANODRIP Oil can serve you as it has Wilson Milk Company. Find out. In the Midwest, call your nearby Standard Oil lubrication specialist. Or contact Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD

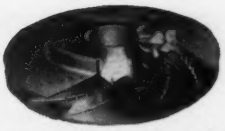
STANDARD OIL COMPANY
(Indiana)



Three bin loaders like the one shown here dripped oil until converted to STANODRIP. No leaks have occurred in 8 months since. Previously, packings were replaced every two months. Even then leakage often recurred as early as two weeks after repacking.

ALLIS-CHALMERS

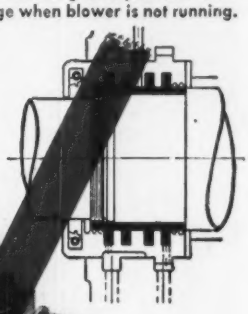
Multi-Stage Centrifugal Blowers

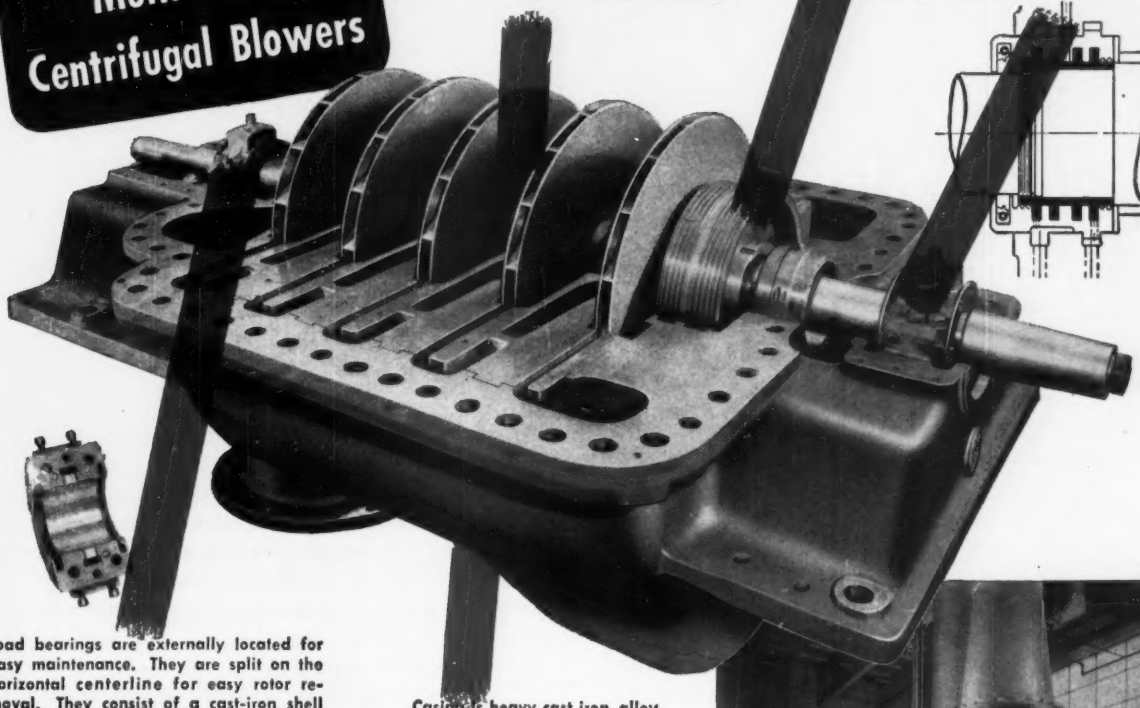


Impeller construction provides unobstructed passage of air or gas. Impellers are furnished in riveted or welded types, as determined by impeller dimension. Note that in riveted impeller wheels, rivets are integral with, and milled from, blade stock.

Impeller wheels are located accurately on shaft with sleeves and are mounted with light shrink fit. Bores are ground to size. Lock nuts prevent axial movement.

Sealing during operation is provided by oil pressure seals. A carbon ring seal prevents leakage when blower is not running.





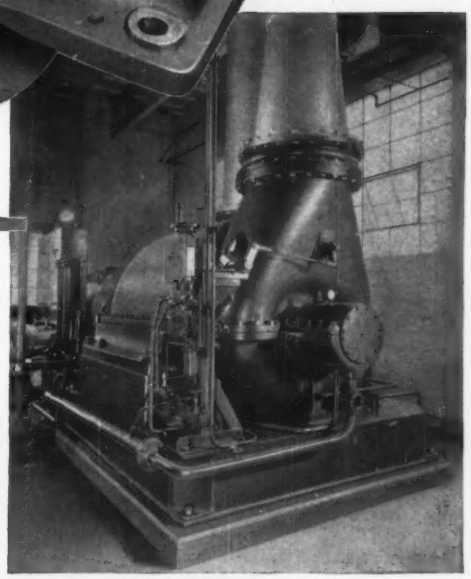
Load bearings are externally located for easy maintenance. They are split on the horizontal centerline for easy rotor removal. They consist of a cast-iron shell with removable, babbit-lined steel inserts.

Casing is heavy cast iron, alloy, or forged steel.

Why these blowers can run for years *without stopping*

The key to "round the clock" performance of blowers in chemical plants is *quality*, as illustrated in the features above.

For highly dependable, low maintenance air and gas handling equipment, as well as motors and control, call your nearby Allis-Chalmers office, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4471



This Allis-Chalmers four-stage centrifugal blower supplies 24,000 cfm to the catalytic cracking tower of an eastern refinery on a 24-hour-a-day basis, month in and month out.

ALLIS-CHALMERS A-C ALLIS-CHALMERS

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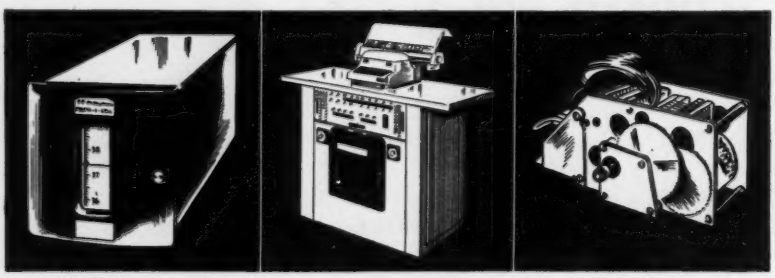
The age of machines that think is here! *The Automatic Logger — developed by Fischer & Porter — is an automatic, high-speed means of scanning masses of heterogeneous information, interpreting it, and making possible a compact report of essential data. A practical step towards complete automation, its industrial applications are numerous.*

The F&P Automatic Logger has broken the time barrier that formerly existed between the measurement of data and its conversion into usable form. Costly, time-consuming manual data handling, and the inevitable possibility of error involved, is now eliminated. This system produces more reliable data in only seconds' time.

Using a single high-accuracy transducer, the F&P Automatic Logger can simultaneously scan, measure and record as many as 200 variables. By converting the measurements into digits, the readings may be recorded as a typewritten column log sheet or as punched tape. Abnormal readings are printed in red—and also may be alarmed. The punched tape can be fed into a tape-to-card converter for automatic computing, or, where a log is not required, the data can be fed directly into computers or punch-card equipment for computing, accounting or control.

F&P Automatic Loggers are currently being used in oil refineries, in chemical, aircraft, and glass plants, and in many research and test facilities to increase production and lower operating costs. Each system comes ready for pneumatic and electric connections — and for your assurance, is fully tested, fully guaranteed.

Fischer & Porter manufactures various other data reduction and automation equipment, such as the Package Recognition and Inventory System, ready made for immediate installation in manufacturing or processing plants. To find out how time-saving data reduction or automation equipment can save money in *your* plant, get in touch with us—no obligation.



Press-I-Cell Pressure Instrument | Automatic Logger | Digi-Coder

FISCHER & PORTER COMPANY

COUNTY LINE ROAD • HATBORO 6, PA.

Measuring, recording and controlling instruments
Centralized control systems
Data reduction and automation systems
Chlorination equipment
Industrial glass products

Sales offices in 32 American cities and in principal cities abroad

this little drip costs you money!

On a 10¢-per-gallon product, 6 CC of leakage per minute costs you about $90 per year in unnecessary product waste.

REPLACE PUMP PACKING WITH

BJ mechanical seals

Eliminate unnecessary stuffingbox leakage by installing a BJ Mechanical Seal. You not only realize important savings of pumped products but you also save on repacking and downtime losses. A BJ Mechanical Seal also prevents contamination of the pumped liquid ... protects against volatile and corrosive liquid hazards.

BJ MAKES A COMPLETE LINE OF MECHANICAL SEALS...

BJ makes reliable high-precision seals in material and construction combinations to answer almost any pressure, temperature and liquid requirements. This means that BJ can provide the *one best seal* for each specific pumping need. Ask your nearest BJ sales engineer to show you how Mechanical Seals can save you money. Or you can obtain further information by writing for BJ Bulletin No. 54-1-10,000.

BJ
SINCE 1872

Byron Jackson
DIVISION OF BORG-WARNER CORPORATION
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Sales Offices in Principal Cities

Nash Instrument Air Compressors deliver only clean air, free from oil or dust, and without filters

Here is Why!

You can dispense with oil filters and dust filters when you install ®Nash® Clean Air Compressors. You can save the cost of maintaining these devices. You can greatly reduce instrument maintenance costs. For the Nash employs no internal lubrication, therefore no troublesome oil is in the delivered air. Moreover, air from a Nash is thoroughly washed and cooled as it passes thru the pump. Dust in the plant atmosphere, even fly ash, is immediately removed.

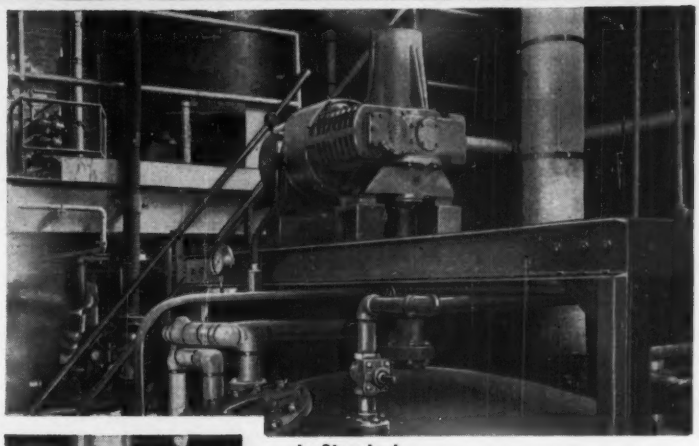
®Nash® Clean Air Compressors are simple, with only one moving element. No valves, gears, pistons, sliding vanes, or other enemies of long life and constant performance complicate a Nash. No aftercoolers are needed. You will find it profitable to investigate these pumps, now.

No oil filters.
No dust filters.
No internal lubrication to contaminate air handled.
No internal wearing parts.
No valves, pistons, or vanes.
Non-pulsating pressure.
Original performance constant over a long pump life.
Low maintenance cost.

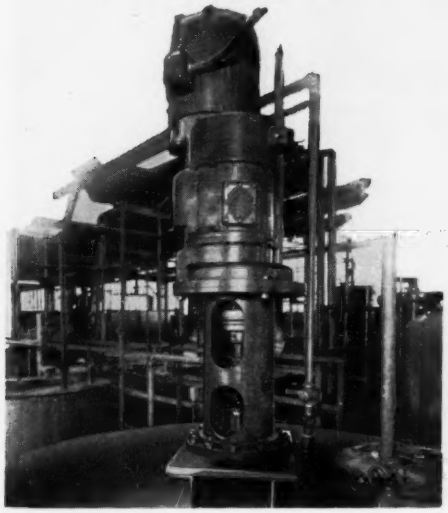
NASH ENGINEERING COMPANY
395 WILSON, SO. NORWALK, CONN.

International MIXERS

In Soaps, Fats, Oils, Paste-Making and Synthetic By-Product operations, "International" equipment is known and used the world over.

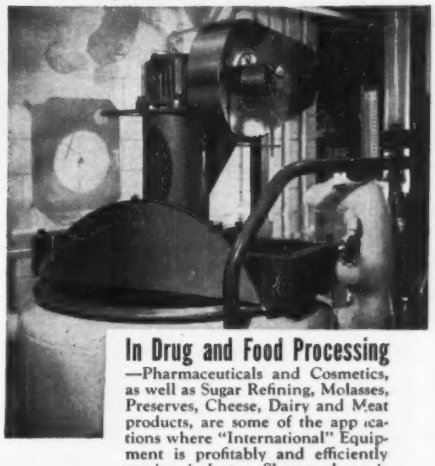


In Chemicals—Cellulose Products, Explosives, Fertilizers, Glass and Ceramics, Liquid Distilling, Paints, Varnishes, Lacquers, Inks and Cleaning Compounds —to mention but a few applications where "International" Mixing and Processing Equipment is vital to economic production.



In Petroleum Products, Lube and Fuel Oil, Gasoline Blending — "International" Top and Side Entering Mixers play an important part in today's ever-expanding industrial growth. You can "Sleep without worry" when you put all your MIXING, BLENDING, TREATING and GRINDING problems up to "International". Our Engirteering Staff and manufacturing facilities are at your service.

In Plastics and Insulation, Textiles, Bleaching, Dyeing, and Finishing, Rubber, and Paper and Pulp Products "International" Equipment is used universally.



In Drug and Food Processing—Pharmaceuticals and Cosmetics, as well as Sugar Refining, Molasses, Preserves, Cheese, Dairy and Meat products, are some of the applications where "International" Equipment is profitably and efficiently serving industry. Shown above is "International" TYPE "LRV"—Variable Speed Mixer, installed in a plant where it is desirable to be able to change shaft speed while Mixer is in full operation. Remember, there is an "International" Type of Mixer to precisely fit your requirements. Your inquiry will bring prompt and complete information on any type of Mixing, Blending, Treating or Grinding Equipment.

"International" Mixing and Processing Equipment

Special Bulletins available on any subject illustrated

INTERNATIONAL ENGINEERING, INC.

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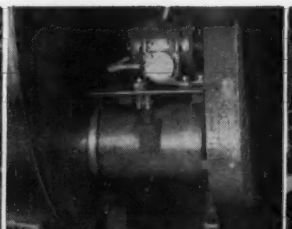
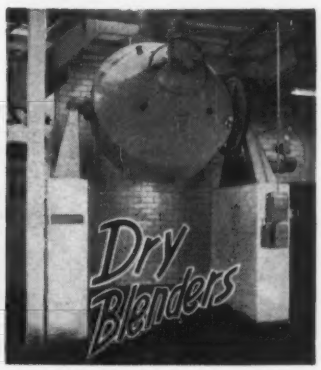
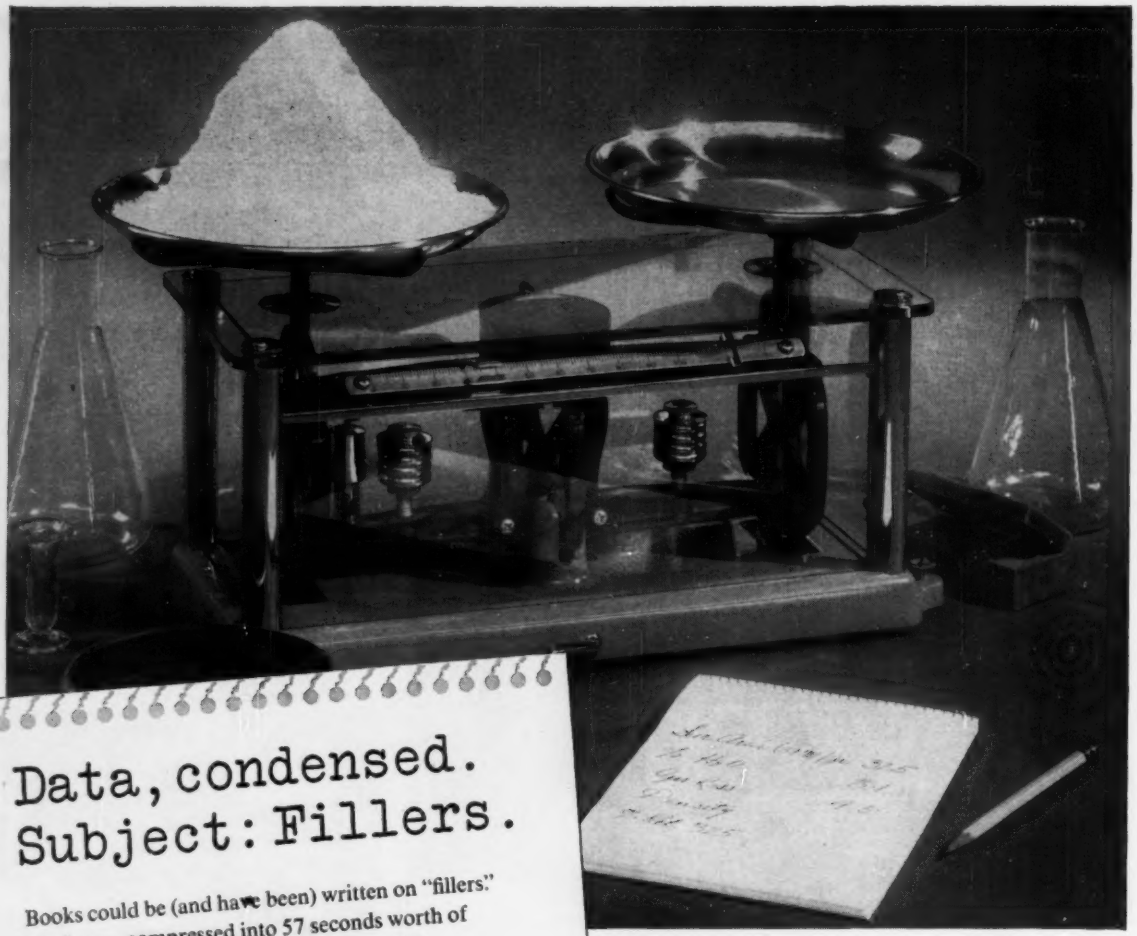
BALL MILLS



Side Entering MIXERS

RIBBON MIXERS





Data, condensed. Subject: Fillers.

Books could be (and have been) written on "fillers." But here—compressed into 57 seconds worth of time—are the salient points of Dicalite filler materials, quick and easy to review for possible application in your own projects.

Dicalite fillers are processed from diatomite into uniform, finely divided amorphous powders, practically pure SiO_2.

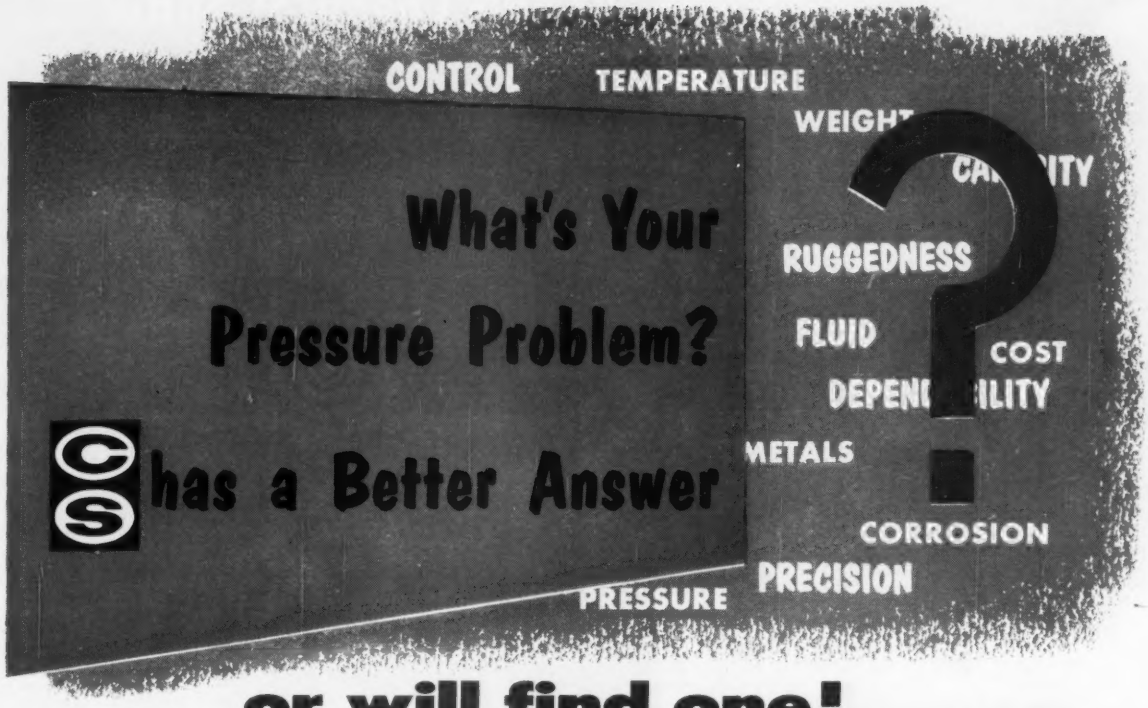
MELTING POINT. 2900°F, approx.
MOISTURE. From 0.1 to 6%, depending on grade.
IGNITION LOSS. 0.1 to 5%, approx.
PARTICLE SIZE. Grades varying in fineness up to trace retained on 325 mesh screen. Coarser available.
POROSITY. 70 to 95%.
SURFACE AREA. 7,000 to 150,000 sq. ft./lb.
DENSITY. 7 to 13 lb./cu. ft., loose weight. Apparent specific gravity, 0.112 to 0.21; actual specific gravity, 2.00 to 2.35.
ABSORPTIVENESS. 120 to 300% of weight of Dicalite.
WETABILITY. Excellent.
INERTNESS. Essentially inert in aqueous and acid solutions.

Dicalite fillers supply bulk without significant weight increase and give added strength and toughness. They also improve flexibility, reduce brittleness, decrease heat conductivity, and improve abrasion resistance. In certain products, appropriate Dicalite materials provide excellent mild polishing qualities.

We will be glad to advise on the most suitable Dicalite grade for your purpose, or to work with you in developing a custom-made filler for your particular needs. Write us.

Dependable GLC GREAT LAKES **Dicalite**® DIATOMACEOUS MATERIALS

DICALITE DIVISION, GREAT LAKES CARBON CORPORATION, 612 SOUTH FLOWER ST., LOS ANGELES 17, CALIFORNIA

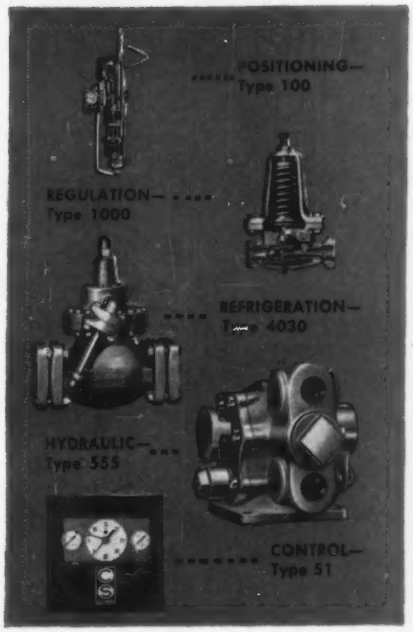


or will find one!

Finding or developing answers that *best suit* individual pressure problems has been Cash Standard's specialty for over a quarter of a century. The solution to *your* problem can be found either in the established Cash Standard line of pressure regulators, instruments and automatic controls, or in Cash Standard's willingness to tackle problems—to modify existing products or design new products to conform precisely to your needs.

For an individual solution to *your* pressure problem, contact the Cash Standard pressure specialist in your area, or write for pressure problem analysis.

Some Applications Served by Cash Standard Pressure Products



CASH STANDARD

A. W. CASH COMPANY, P. O. Box 551, Decatur, Illinois

Pressure, Hydraulic, Temperature, Process and Combustion Controls

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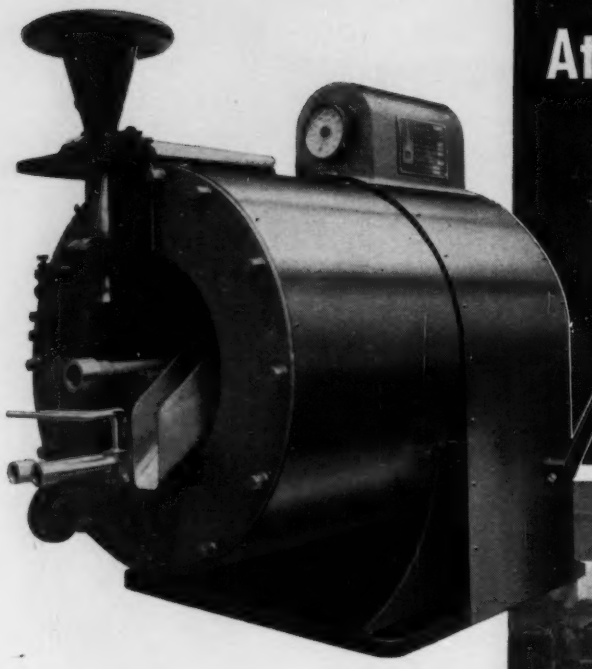
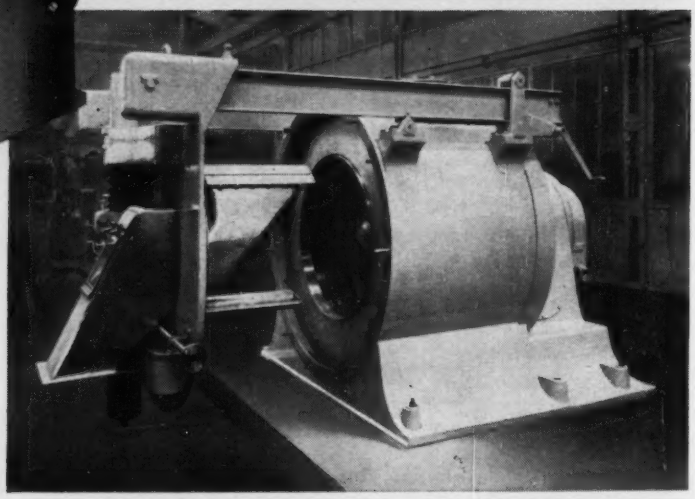


At the Chemical Show . . .

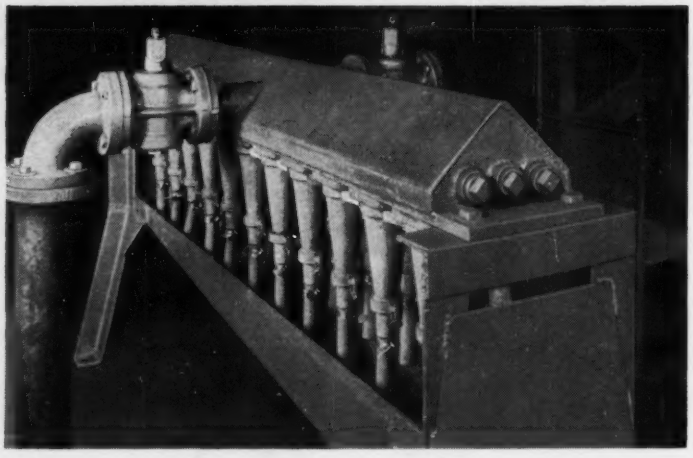
Booth #226

HEYL & PATTERSON

presents:



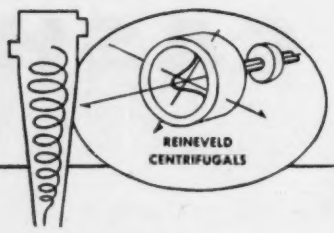
Reineveld Centrifugals



H & P Cyclone Thickeners and Classifiers

Heyl & Patterson

INC.



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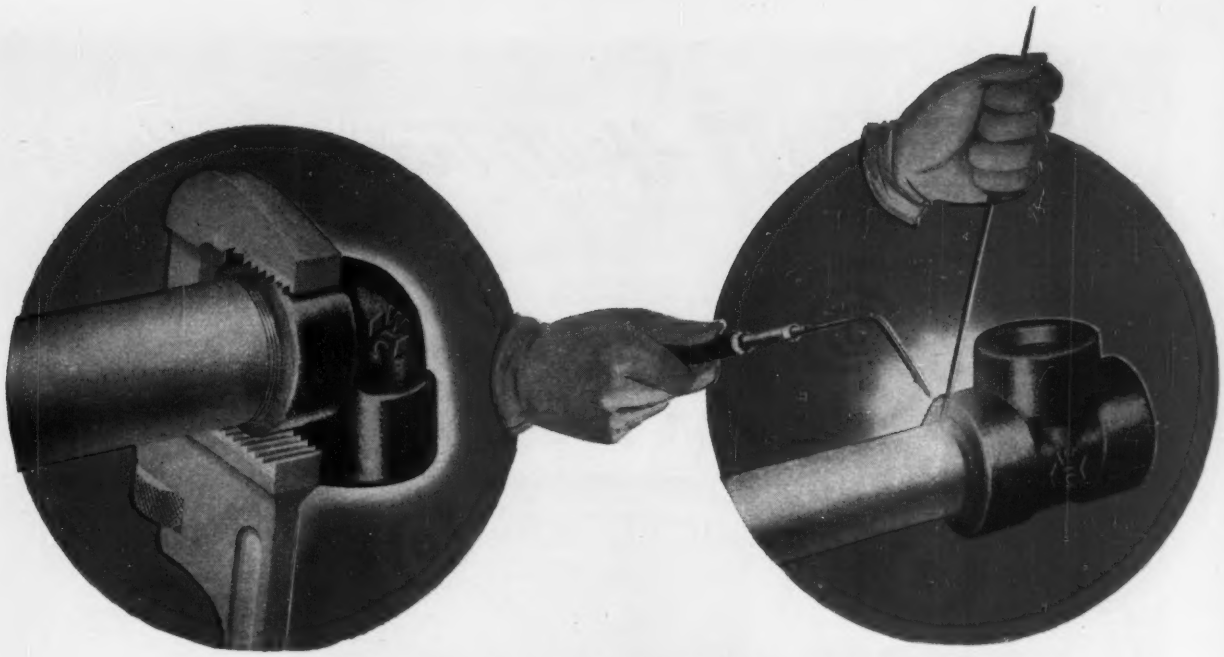
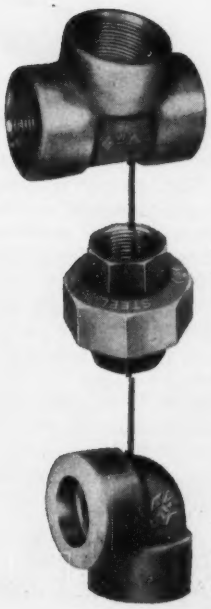
PHONE COurt 1-0750



INSTALL WATSON-STILLMAN FORGED STEEL FITTINGS...

...and get THESE IMPORTANT ADVANTAGES:

- Resistance to Pressure, Heat and Corrosion
- Long Service Life
- Low Maintenance Costs



Watson-Stillman Forged Steel Pipe Fittings are fabricated and designed for tough service...and long service. They're drop forged of high quality metal to produce a strong, tough, fiber structure that resists the stresses of high pressures, shock and vibration. And our forged stainless and alloy steel fittings give you the added advantages of resistance to high temperatures and corrosion. Watson-Stillman Fittings assure you of safe, reliable service in process lines, high pressure steam lines and other arteries of the operating equipment in your plant.

You can obtain a complete line of W-S fittings to suit your service and fabrication requirements. Available in Screw-End and Socket-Welding Types in Carbon Steel, 1¼% Chrome-½% Moly steel, 2¼% Chrome-1% Moly steel, Types 304, 316 and 347 stainless steel and Monel.

Send today for our informative bulletins.

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WATSON-STILLMAN FITTINGS DIVISION

H. K. PORTER COMPANY, INC.

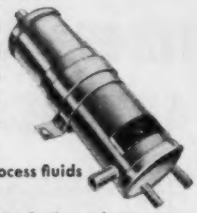
Roselle, N. J.

Young Heat Transfer News

YOUNG RADIATOR COMPANY, RACINE, WIS.

New Corrosion Resistant Young Heat Exchangers withstand Expansion Strains; are Easy to Clean

Ideal for pilot plants and other fluid testing operations, the Young Radiator Company Sample Fluid Cooler is used for sampling boiler water, high temperature process fluids or other mediums.



The Young Sample Fluid Cooler reduces sample fluid temperatures from 600° F., to 100° F., at pressures up to 1500 psi.

Practical construction of the Coolers eliminates crevice corrosion or metal failure from continuous use.

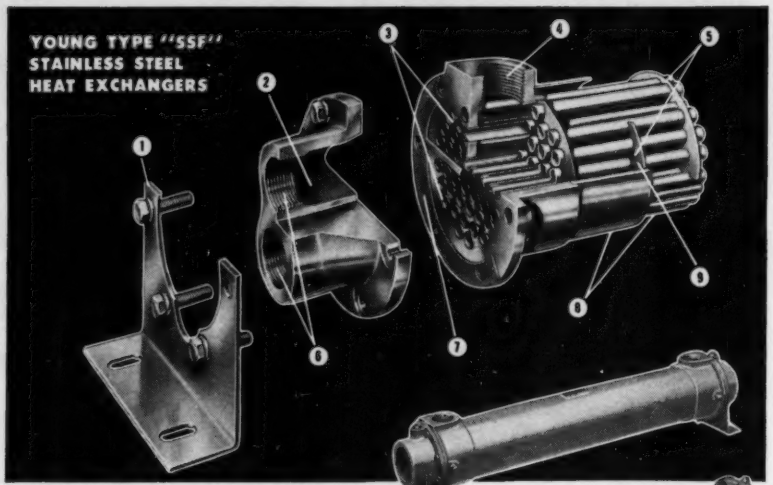
Young Coolers have ample-sized inlet and outlets for minimum resistance to fluid flow. Designed as a compact, space-saving unit, joints are alloy brazed to provide a permanent, leakproof assembly. Tubes, shell, end caps and pipe connections are of corrosion-resistant materials.

For more detailed information on Young Sample Fluid Coolers, write for free Bulletin No. 2125 to, Young Radiator Company, Dept. L-315, Racine, Wisconsin.

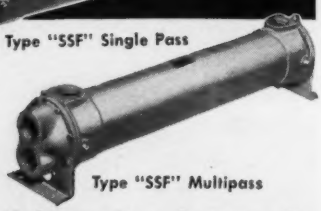
See Young Stainless Steel Heat Exchangers at the 25th Exposition of Chemical Industries at Philadelphia.

Booth No. C-162

Young Stainless Steel Heat Exchangers will be on exhibit through December 9. Company engineers will be happy to answer your questions.



Type "SSF" Single Pass



Type "SSF" Multipass

Stainless Models Include Factors for Fouling, Safety Reserve Capacity

Specially designed to cool or heat fluids or gases used in the chemical, pharmaceutical, refining and allied processing industries, new Young Radiator Company Stainless Steel Fixed Tube Bundle Heat Exchangers provide these features:

Sturdy mounting brackets (1) are adjustable for installation in any location. Smooth flow bonnet (2) distributes fluid with minimum turbulence to tubes. Tubes are rolled into headers (3) and mechanically expanded to form a sturdy joint. This prevents leakage due to vibration and temperature changes.

Full flow opening (4) minimizes pressure drop. Special baffles (5) are spaced for maximum heat transfer. Full flow coolant opening (6) maintains pressure, and quality gasket (7) of heat resistant material eliminates by-passing of liquid and prevents leakage.

Shell and tubes are available in a variety of diameters and lengths (8) to best suit your heat transfer requirements.

Entire Young Heat Exchanger is precision-built (9) with baffles manufactured to close tolerance.

For further Stainless Steel Heat Exchanger details, write for free catalog.

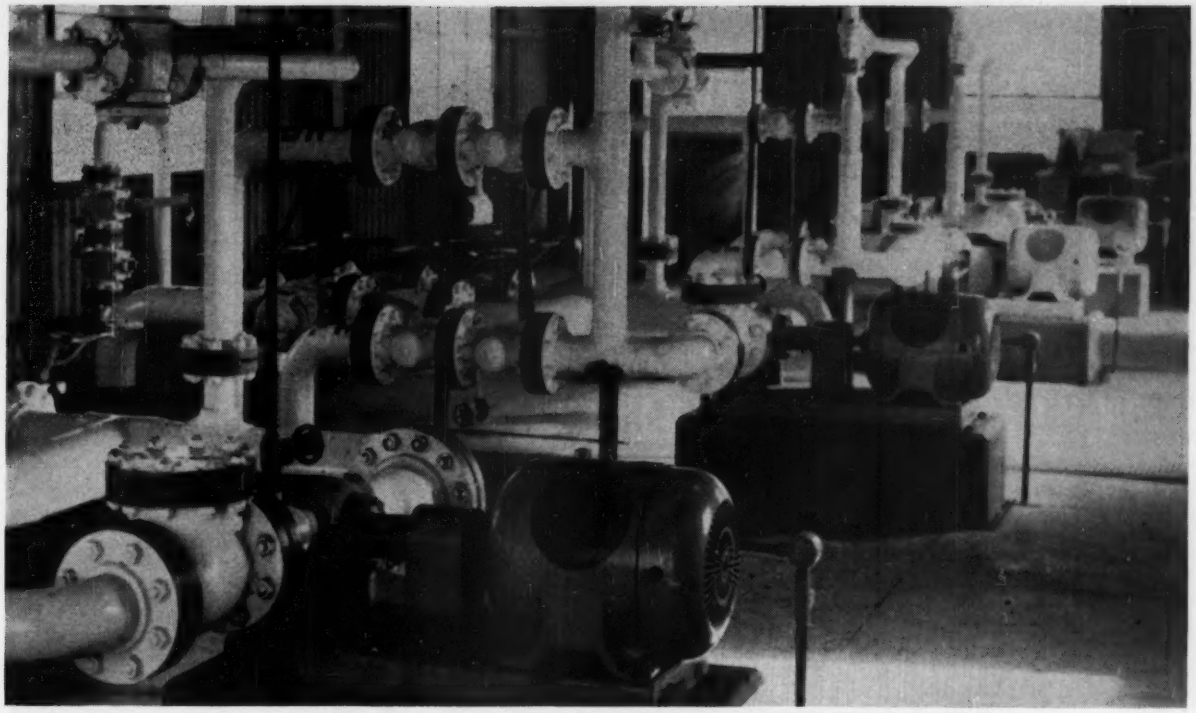
Young RADIATOR COMPANY

RACINE, WISCONSIN

Creative HEAT TRANSFER ENGINEERS FOR INDUSTRY

Heat Transfer Products for Automotive, Aviation and Industrial Applications. Heating, Cooling, Air Conditioning Products for Home and Industry.

Executive Office: Racine, Wisconsin, Plants at Racine, Wisconsin, Mattoon, Illinois

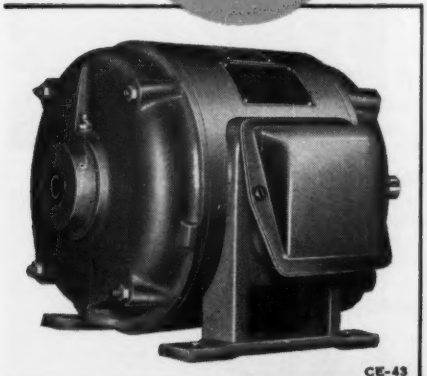


7½ H.P. Century motors drive loading pumps in a processing plant.

Protect your production...

WITH THE DEPENDABLE POWER OF

Century Performance-Rated© MOTORS



CE-43

Modern production machines are designed for new speed and efficiency. But to deliver their finest performance, they require precisely the right type and size of motor . . . Performance-Rated Century Motors!

Performance-Rating is the simple process of selecting motors with the correct size, speed, frame, mounting and torque characteristics to fit your machine requirements. It's easy. From Century's unusually wide selection, you can choose motors from ⅛ to 400 H.P., A.C. or D.C., single phase or polyphase, drip proof, dust proof or explosion proof frames (plus optional corrosion-resistant features, constant speed, multi-speed, varying speed or geared speeds).

For full information, call the Century District Sales Office or Authorized Distributor nearest you.

Century Performance-Rated© Motors 1/8 to 400 H.P.

C

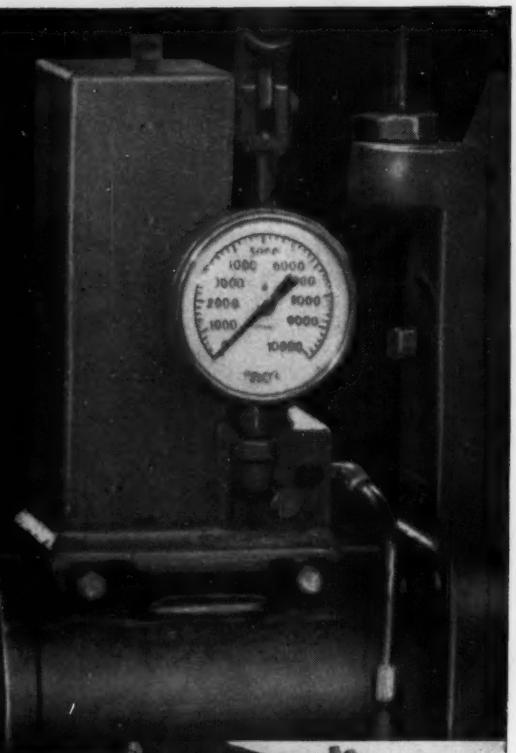
CENTURY ELECTRIC COMPANY

1806 Pine Street • St. Louis 3, Missouri • *Offices and Stock Points in Principal Cities*

new SPERRY "HANDRAULIC"

Closing Device

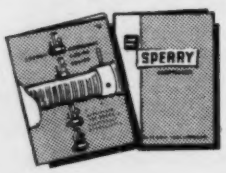
EASIEST to INSTALL and OPERATE . . . .



BRINGS NEW FILTRATION ECONOMY TO NEW OR EXISTING FILTER PRESSES!

Now — without re-boring . . . without altering parts . . . without removing so much as one plate — you can modernize your present filter press with one of the newest, most advanced of all labor-saving devices — the "HANDRAULIC" Closing Device by Sperry. (Or you can specify the "HANDRAULIC" as original equipment on new Sperry Filter Presses.)

On existing presses, simply remove one bolt . . . slip the "HANDRAULIC" in place . . . tighten the cap-screw . . . and that's it! Releases a powerful hydraulic surge for opening and closing the filter press . . . in seconds . . . without operator fatigue. And because the "HANDRAULIC" requires no extra support or foundation, it's practically portable. Replaces the filler block . . . takes up no extra space . . . and angles out of position to provide the maximum space for cleaning and maintenance.



SEND FOR FREE NEW BOOKLET

describing the "HANDRAULIC'S" simple erection and operating directions that can save you time, labor, material, and money. Also ask for Sperry's new, illustrated 42-page Filter Press Catalog. Both books are important . . . both are free. Send for your copies, today!

Eastern Sales Representative:
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Filtration Engineers for More than 60 Years

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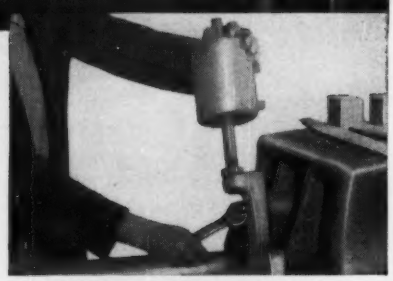
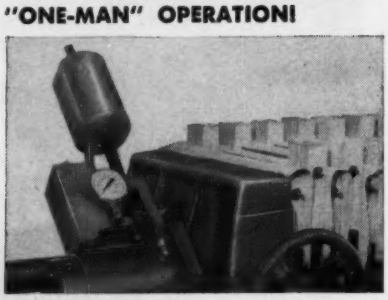


"ONE-BOLT" INSTALLATION!

"ONE-MAN" OPERATION!



"ONE-MOTION" CLEANING PROCEDURE!

Swing Handraulic to horizontal positon, move slide head to open position, and filter press is ready for cleaning.

Transformer Oil must stay water-free

—so shippers equip their drums with

Tri-Sure®

Closures

REMOVE GRIP TAB AND TEAR
CAUTION
BEFORE SIGNING TRANSPORTATION RECEIPT NOTE ANY DAMAGE OR SHORTAGE. NOTED ON FREIGHT BILL.
STORE DRUMS ON SIDE IN A DRY PLACE WITH BUNGS ABOUT MIDWAY ON HEAD OF DRUM.
TEST OIL FOR DIELECTRIC STRENGTH BEFORE PLACING IN APPARATUS. IT IS RECOMMENDED THAT OIL BE TRANSFERRED TO APPARATUS THROUGH A FILTER PRESS.
U.S. & FOREIGN PATS. PEND.
Tri-Sure

Water in transformer oil is dangerous. It is essential that every drum of transformer oil be *securely sealed* against leakage or breathing-in.

Most fillers and shippers of transformer oil make it standard policy to equip their drums with *Tri-Sure* Closures* — because experience has proved that the Tri-Sure Seal, Plug and Flange, beside providing the most dependable protection against outward leakage, provide equal protection against the intake of moisture and other contaminating material.

When the Tri-Sure Seal, with its flowed-in gasket, is properly crimped over the gasketed Tri-Sure Plug and Flange, it makes a perfectly leak-proof engagement which averts any possibility of moisture or impurities reaching the contents of the container.

The experience of shippers shows that — even after long exposure to adverse conditions — the contents of Tri-Sure equipped drums remain in their original state.

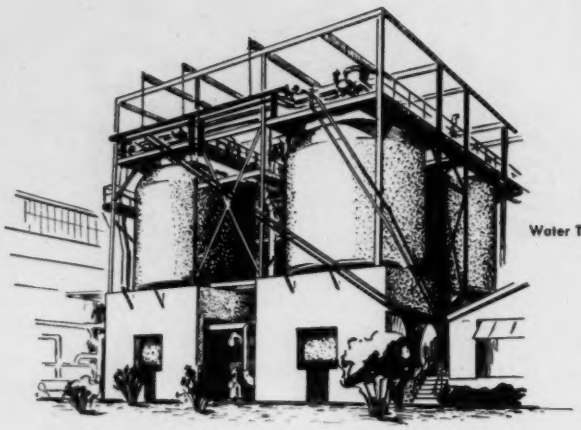
Whether you ship transformer oil, or any other oil or chemical, if your product needs unfailing protection from leakage and contamination, you can depend on Tri-Sure Closures. *Specify them* when you order drums.

**The "Tri-Sure" Trademark is a mark of reliability backed by over 35 years serving industry. It tells your customers that genuine Tri-Sure Flanges (inserted with genuine Tri-Sure dies), Plugs and Seals have been used.*

AMERICAN FLANGE & MANUFACTURING CO. INC., 30 ROCKEFELLER PLAZA, NEW YORK 20, N.Y.

Tri-Sure Products Limited, St. Catharines, Ontario, Canada
Tri-Sure S/A Indústria e Comércio, Sao Paulo, Brazil
B. Van Leer N. V., Stadhouderskade 6, Amsterdam, Holland
Van Leer Industries, Ltd., Seymour House, 17 Waterloo Place, Pall Mall S.W. 1, London, England

Always specify **Tri-Sure** Reg. U. S. Pat. Off. **CLOSURES**



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Producing Units

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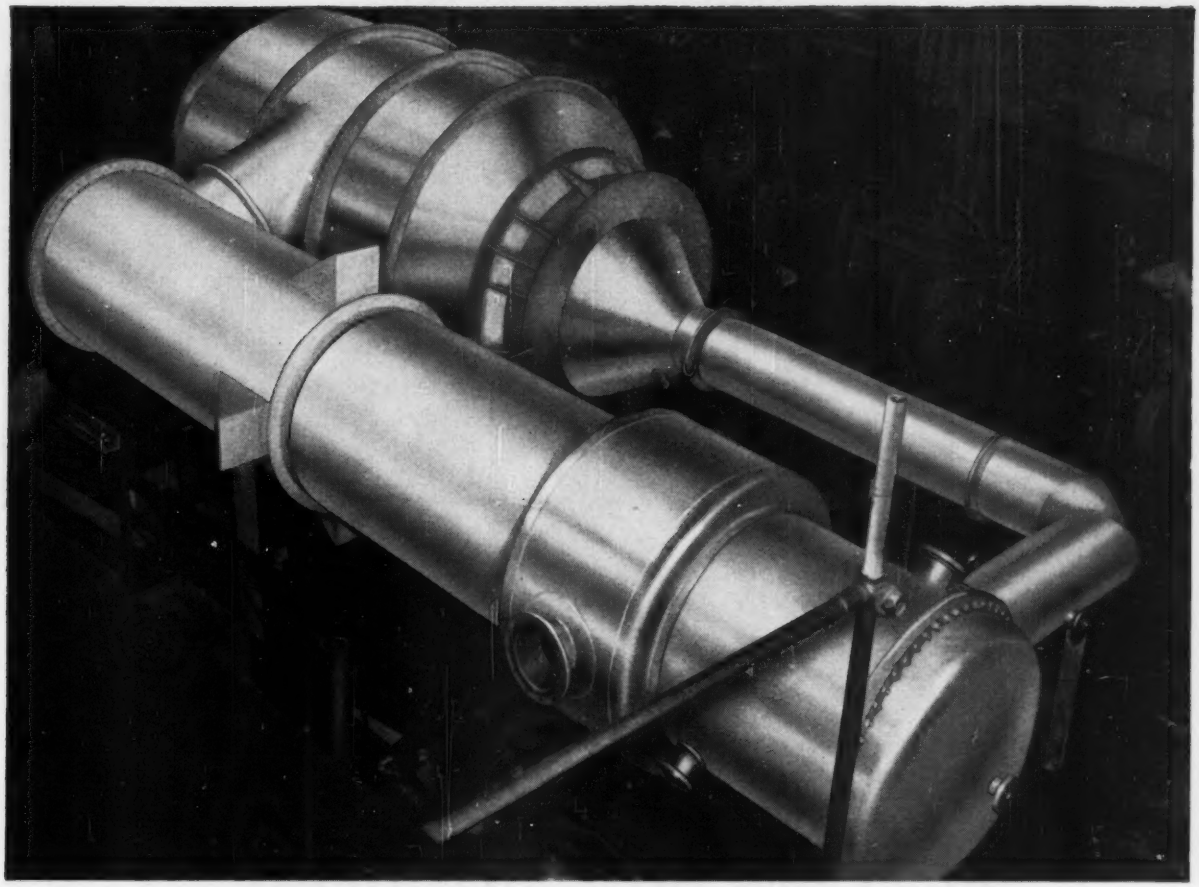


Why STAINLESS STEEL is best for processing Glacial Acetic Acid

This special type calandria evaporator processes glacial acetic acid. Yet its vital parts—tubes . . . liquid and vapor heads . . . downleg and centrifugal separator—are almost indestructible in this service. That's because they're fabricated of Crucible stainless steel, type 316.

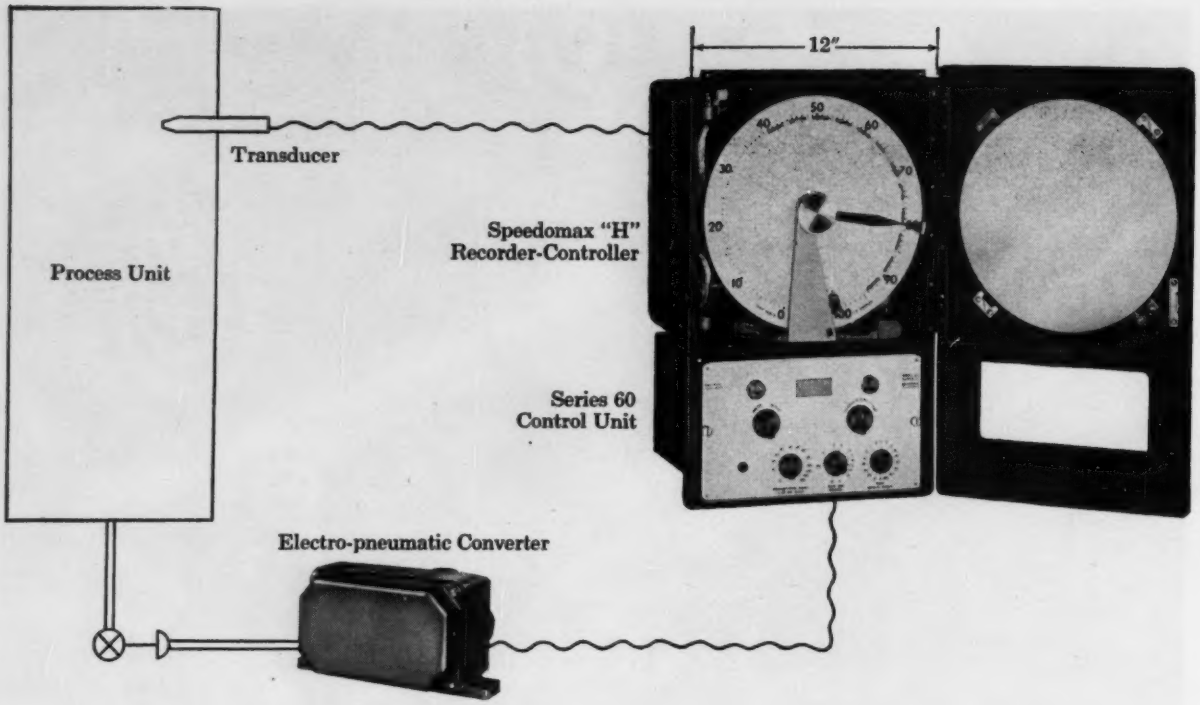
The fabricator, Badger Manufacturing Company, chose type 316 stainless because it is one of the best known alloys for handling acetic acid. It is completely resistant to acetic acid in all concentrations, and under the majority of pressure and temperature conditions. And, most important, stainless steel does not contaminate glacial acetic acid.

Its *physical* properties make stainless a wise choice, too. Its high tensile strength means minimum structural support. Its practical workability permits forming complex sections without undue trouble. And these sections are readily welded, since type 316 is designed to inhibit the precipitation of harmful carbides on cooling from high temperatures.

If you're concerned with the manufacture or use of chemical processing equipment, check the advantages offered by the 30 available types of Crucible stainless steel. Your nearby Crucible representative will be glad to give you more details. Or, for an over-all look at the many uses of stainless, write for "Making the Most of Stainless Steels in the Chemical Processing Industry." *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America



L&N'S NEW C.A.T. ELECTRO-PNEUMATIC CONTROL

gives you these advantages:

- **FAST ELECTRICAL RESPONSE in measurement, control, transmission.**
- **SIMPLICITY, LOW COST, ADAPTABILITY and the special safety of pneumatic operation.**
- **EASY INSTALLATION with only 1 pair of leadwires from the control unit to the converter mounted near the process; then short air lines from converter to valve.**

L&N's C. A. T. (Current-adjusting type) Control combines the advantages of pneumatic valve operation with the flexibility and fast response of an electrical control system. The electrical signal produced by a change in the process variable passes from transducer, to Speedomax recorder, to L&N Control Unit. Here, the properly tuned combination of proportional, rate, and reset actions produces a control current which is fed to the Electro-pneumatic Converter. The Converter matches the control characteristics of the current output with an air pressure which operates the pneumatic valve.

The L&N Control Unit and all of its replacement parts are "plug-in" type for fast, easy servicing. The Unit's proportional band is adjustable from 0 to 500% of recorder range, rate time is continuously adjustable from 0 to 8 minutes, and reset action runs from 0 to 100 repeats per minute.

The force-balance type Electro-pneumatic Converter is ideal for installation directly on the process unit. It can be mounted anywhere, in any position; is vibration-resistant and weather-proof. Its minute (5 milliamp) current and continuous air purge provide a wide safety margin for operation in hazardous areas. If power fails or the control unit is removed, the control valve is sealed in its last position. And the Converter is so sensitive that its dead band is less than 0.1%.

C. A. T. Electro-pneumatic Control may well be the answer to your control needs. For details, write for Folder ND4(8). The address—Leeds & Northrup Co., 4916 Stenton Ave., Phila. 44, Pa.

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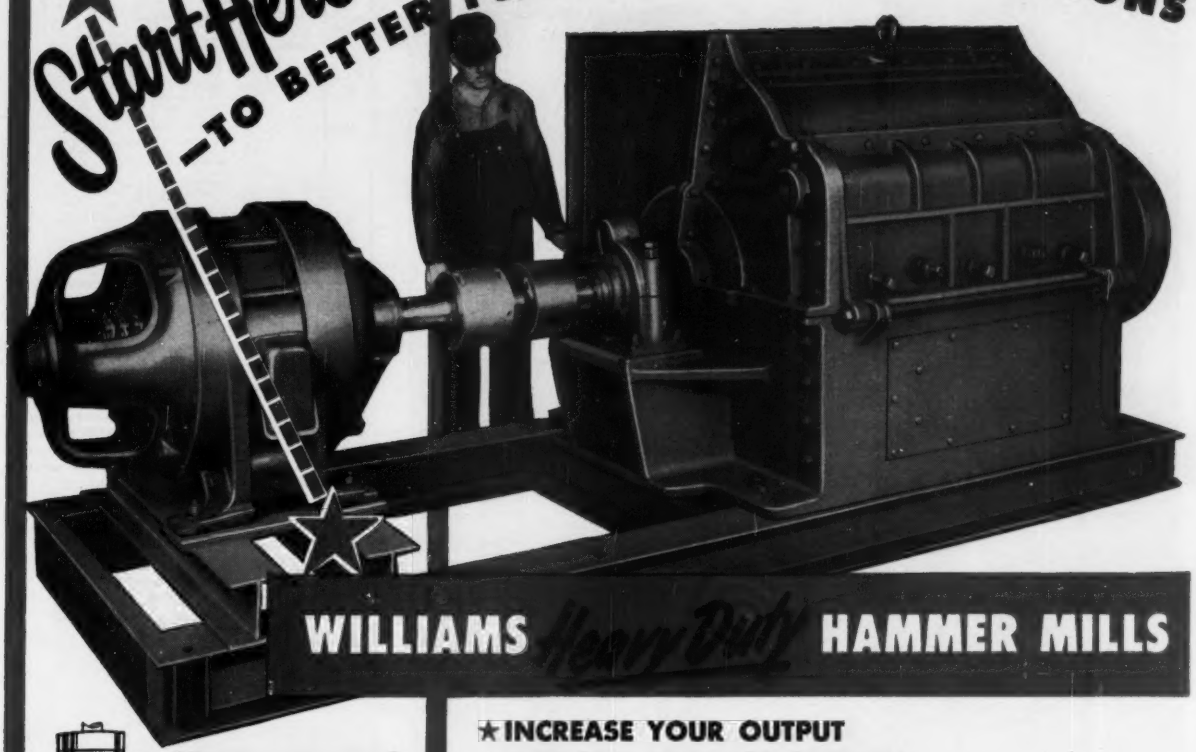
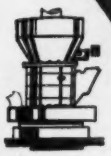


WILLIAMS *Heavy Duty* HAMMER MILLS



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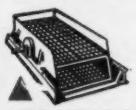
▲ **AIR SEPARATORS**
— any type; for precision control and high production in fine grinding



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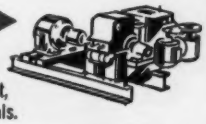
1 to 3 decks, — in any size for any job. open or enclosed.

HELIX-SEAL MILLS
— for dust-free grinding, and for wet, sticky, greasy materials.



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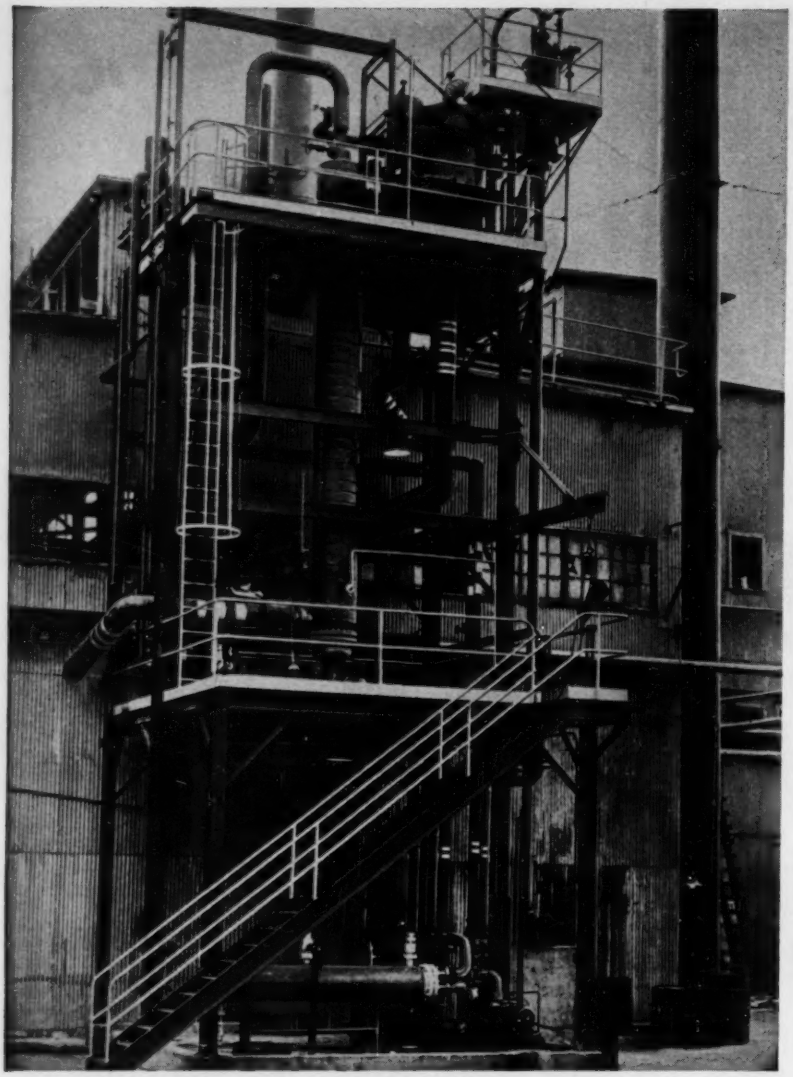
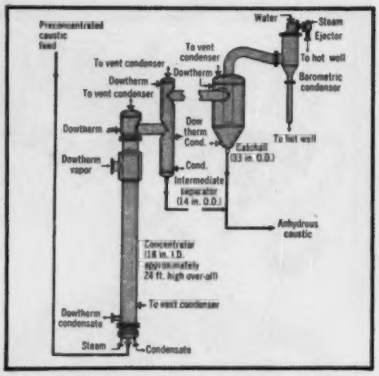
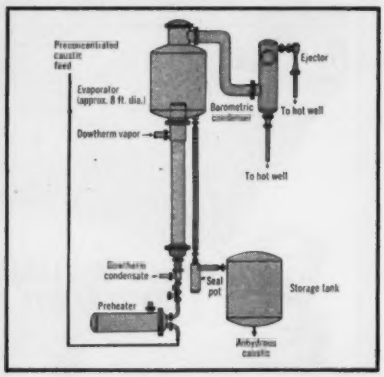


Nine years commercial experience in the continuous finishing of anhydrous caustic soda in this pioneer Swenson Evaporator shows • • •



Schematic drawing of pioneer Swenson Evaporator shown in photograph. Operators say continuous finishing is easy to control automatically and uses only ½ as much fuel as batch finishing.

The information on the continuous caustic finishing unit is published through the courtesy of the Swenson Evaporator Company and Dr. W. L. Badger, originator of the process and designer of the unit.



Schematic drawing of present simplified Swenson Evaporators. In these later units, jacketing is eliminated; thermal insulation prevents freeze-up. Low-carbon nickel tubes, tube sheets, shells and piping keep corrosion low and prevent product contamination.

You don't have to "shade" solid NaOH made in nickel

What's more . . .

- **With good control of chlorate, metal pick-up does not exceed 1 or 2 parts per million.**
- **Original equipment costs only 1/5 as much as a batch-finishing, direct-fired, iron pot installation of equal capacity.**
- **A set of nickel tubes can finish some 17,000 tons of caustic and costs less than 1/2 as much to replace as pots.**

Modern practice is to produce 99.5% solid NaOH continuously in Dowtherm*heated evaporators with contact surfaces of corrosion-resistant nickel. Feed is either 50 or 73% NaOH from which chlorates have been removed by chemical reduction.

"Shading" pots originally installed with the Swenson Evaporator shown, have never been needed. In later installations, caustic is packed directly from the nickel storage tanks without "shading" or final purification.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

For further information on continuous caustic finishing units, write Swenson Evaporator Company, Harvey, Illinois. For assistance with caustic corrosion problems, contact Inco's Corrosion Engineering Section.

*Trademark of the Dow Chemical Company

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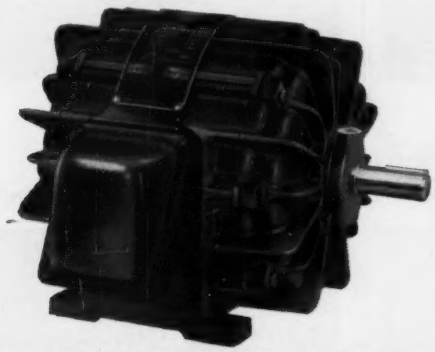
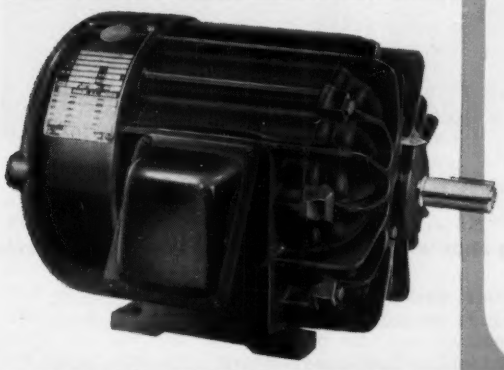


Type "DIE" Motor (Not Fan-Cooled)



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Smaller in size, lighter in weight, precision-engineered and precision-built to new NEMA standards, they are ideally suited to "air-over-motor" applications where moisture, fumes, dust and other airborne particles are a problem ... a field in which Diehl has long been a leader.

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Electrical Division of THE SINGER MANUFACTURING COMPANY
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Please send me the following bulletins:

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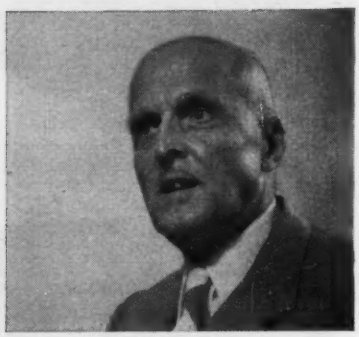

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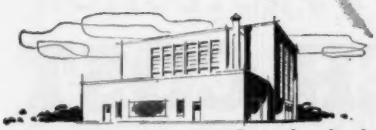
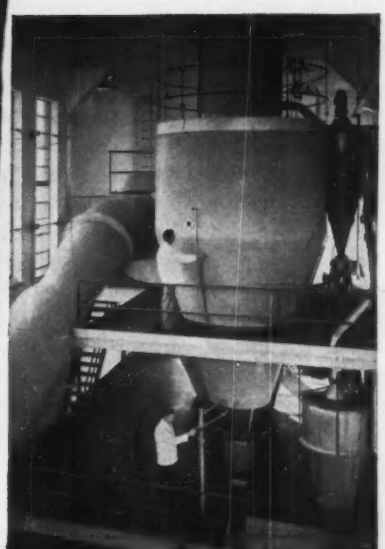


You can test your product—by the barrel or carload —in Swenson's Spray Dryer Laboratory!

Can your product be successfully spray dryed to take on a new form, get more markets, or a bigger profit potential? You can find out—*for sure!* Swenson's Spray Dryer Laboratory—the world's most advanced—at Harvey, Illinois, is devoted to answering just such questions for you.

Here Swenson engineers carefully test and analyze your product's potential in a commercial size spray dryer, matching actual production conditions. If a test quantity can pass all of the requirements here, chances are that *any quantity* can be successfully spray dryed *in your own plant.* You'll definitely know all the facts *before* major investment is required.

You are cordially invited to take advantage of these unique facilities. Swenson is ready to help you in every phase . . . analysis, layout, design and manufacture of equipment, and initial supervision of the job. Discuss it with Swenson now.



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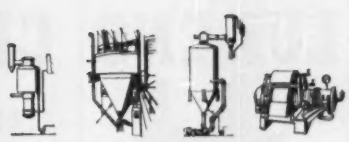

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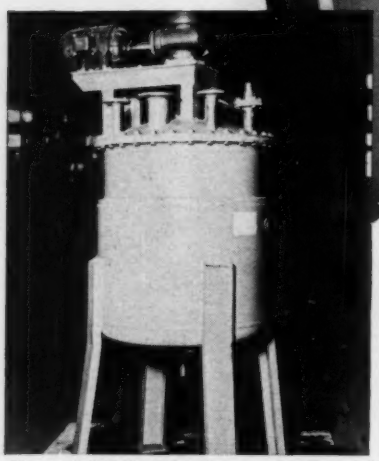
STRUCTURAL STABILITY—
Low-cost carbon steel backing provides necessary strength and rigidity.
DESIGN FREEDOM—
Integral bond allows design and fabrication of shapes to meet process and space needs.
ECONOMY—
High-alloy layer assures corrosion resistance, long equipment life.



This nickel-clad steel tank processes essential oils, was designed to operate at 100 psi. pressure.

CLAD STEEL EQUIPMENT GIVES SOLID HIGH-ALLOY PROTECTION AT LOWER COST

Where protection from corrosion, abrasion, and forms of product contamination such as metallic pick-up is a "must", clad steel equipment is often the *economical* answer. Under pressure, vacuum or thermal cyclical service, the high-alloy cladding will not tear away nor will bond failure permit liquid seepage between cladding and backing. If processes change, equipment modifications can be readily made without injuring the clad surface or bond. The smooth contours and joints possible with clad mean easy cleaning and low maintenance, too.

Why pay a premium for protection in your new processing equipment? Lukens Clad Steels—stainless, nickel, Monel, Inconel, copper—give you all the advantages of these solid high-alloys with savings up to 50% in material costs.

When you're thinking of new tanks and vessels, *qualified* equipment builders can assist from the earliest stages of planning. Working with your engineers and consultants, they know how to help minimize first cost and assure trouble-free equipment life with clad steel. We offer the widest range of clad steels available and work closely with fabricators to help select the type most suited to your processing needs. If you would like further information, ask one of your builders or write Manager, Marketing Service, Lukens Steel Company, 749 Lukens Building, Coatesville, Pennsylvania.

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Speed Reactions, Improve Yields with Sodium Dispersions

Microscopic particles of sodium dispersed in an inert medium offer definite advantages over bulk sodium in many reactions. Yields are better, reactions faster— frequently at lower temperatures.

Sodium dispersions were first developed by Du Pont* and are particularly useful in systems where sodium is insoluble. In such cases, reaction time is a function of the surface area of the sodium, and in dispersion form, the total surface area exposed is extremely large. Finely divided sodium dispersed in various media gives excellent reaction rates and yields in sodium-organic reactions, and makes

possible many reactions which cannot be carried out with the solid or molten metal.

Find out more about sodium dispersions and how you can use them to advantage by checking the coupon below.

**U.S.P. 2394608—Applied for 1944*

New Technique for Preparing Peracetic Acid

If you use peracetic acid oxidation in your process or laboratory, you can now sidestep a number of the disadvantages usually associated with this chemical by using a new technique developed in Du Pont's laboratories.

The technique consists simply in passing hydrogen peroxide and glacial acetic acid through a cation exchange resin. By this method, the hydrogen peroxide is transformed into its more active form, peracetic acid, without the disadvantages of high costs and difficulties in handling and storage. The method can be carried out either continuously or batchwise, and the peracetic acid solutions are free of traces of acid catalyst—no neutralization is necessary.

A new booklet fully describing this technique for preparing peracetic acid is now available from Du Pont. For your copy, check the coupon.

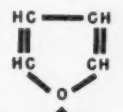
Tough Greaseproof Protection for Paper from "Elvanol" Polyvinyl Alcohol

Tough, flexible films that find many uses on paper products can be produced from solutions of "Elvanol" polyvinyl alcohol. "Slush-coating" of fiber drums, for example, produces a rugged, greaseproof coating ideal for the packaging of oily or greasy materials.

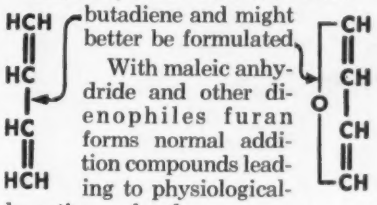
Completely hydrolyzed grades of "Elvanol" form excellent greaseproof coatings for packaging nuts, doughnuts, cookies, etc. Durable coatings are easily applied, provide a protective barrier against air—so important in food wrapping—and take customary folds, creases and hard wear without cracking.

These are just a few of the many jobs "Elvanol" can do. For more ideas on how it can be put to work for you, simply fill out and mail the coupon below today.

Furan—A New Conjugated Diene



Usually written ⬟ to show aromatic behavior, furan often reacts like butadiene and might better be formulated



With maleic anhydride and other dienophiles furan forms normal addition compounds leading to physiologically active molecules.

Halogens in alcohols react by 1,4 addition, forming 2 5-dialkoxy 2,5-dihydrofurans—convenient sources of maleic and succinic dialdehydes.

Cyanogen bromide first adds 1,4 to furan, then, by elimination of either hydrogen bromide or hydrogen cyanide, forms 2-cyano or 2-bromo-furan. Nitration with nitric acid in acetic anhydride proceeds in an analogous fashion, giving 2-nitro furan.

With ethyl, phenyl or thienyl sodium, furan reacts to form 2-furyl sodium. Reaction with potassium or sodium-potassium alloy gives 2-furyl potassium. Amyl sodium introduces two sodium atoms in the furan ring and subsequent carbonation gives 2, 5-furan dicarboxylic acid.

For more information about this reactive compound, mail the coupon.

E. I. du Pont de Nemours & Co. (Inc.)
11507 Nemours Bldg., Wilmington, Del.

Please send me literature and information on: (CE-11)

- ☐ Sodium
- ☐ Peracetic Acid
- ☐ "Elvanol" polyvinyl alcohol
- ☐ Furan

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Among recent developments are irregular shaped porous pellets, termed "Poly-surface." These provide improved adherence of catalyst, low pressure loss, and lowest density.

Because fluidized processes are becoming increasingly important, we have available small Poly-surface pellets that are individually porous. These absorb internally as well as externally, and expose the catalyst continuously, in spite of attrition.

Both the Poly-surface and symmetrical pellets are highly refractory and resistant to most acids. Their attrition loss is low. Porosity ranges from 20% to 60%; water absorption from 8% to 60% by weight. Bulk densities range from 30 to 92 lbs per cu ft.

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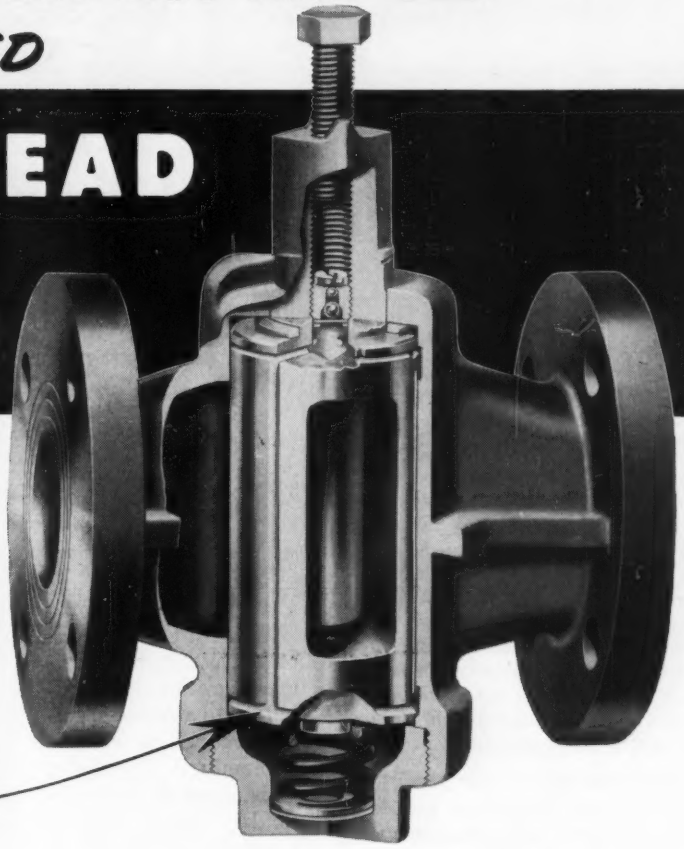
YOU SHOULD BUY AND USE
LOW-PRICED
HOMESTEAD
Lubricated PLUG VALVES



*SELF-FREEING PLUG PREVENTS STICKING

Homestead's exclusive completely controlled lubricant system positively prevents sticking by its instant, piston-like movement of the plug downward at the start of each lubrication. Spring and line pressure return it to stem-sealed position.

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HERE ARE ALL TWELVE

1. Extra long valve life assured by very close tolerance between sealing surfaces.
2. Straight line fluid flow—streamlined ports—minimum resistance to flow—minimum pressure drop.
3. Triple head seal—two lubricant rings and reinforced Teflon stem seal prevent leakage.
4. Easy turning—plug floated on Teflon washer and reinforced Teflon ring.
5. Leak-proof double ball and lubricant sealed check valve. No springs. No maintenance.
6. Full-threaded screw prevents dirt being forced into lubricant system.
7. Quarter-turn fully opens or closes.
8. Reinforced Teflon stem seal—no cold flow—continuous, positive seal.
9. Seating surfaces protected in both open and closed positions.
10. High pressure lubricant system provides full lubricant seal around ports.
11. Self-freeing plug prevents sticking.
12. Two lubricants handle most services.

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HOMESTEAD
VALVE MANUFACTURING COMPANY
"Serving Since 1892"

P. O. Box 13 **Coraopolis, Pa.**

Without obligation, send Reference Book 39—Section 5 on HOMESTEAD LUBRICATED PLUG VALVES.

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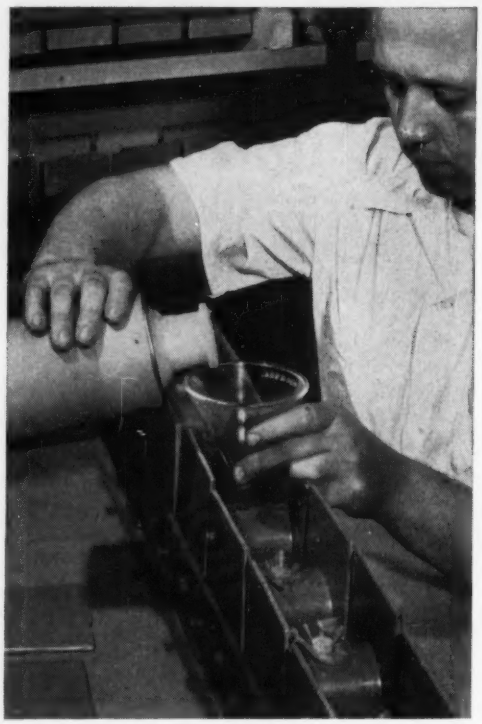
UNICHROME Trade Mark

News about
COATINGS for METALS
Metallic . . . . . Organic . . . . . Decorative . . . . . Protective

Finding the right linings for drums

Four types of Unichrome Drum Linings prove satisfactory for most chemical resistance needs



By such simple yet reliable means as test cells, resistance of *various* drum lining formulations to any one specific product is readily determined. Similarly, resistances of one particular lining to a whole range of chemicals is just as easily gauged.

THE AIMS

United Chromium make such tests by the hundreds of cells. This effort is aimed at improving existing coatings for drum lining service; at sizing up the worth of newly developed coating materials; at helping processors find the one best lining for a particular product to be packaged, shipped or stored in drums.

Coatings meeting chemical resistance requirements are double-checked for impact resistance, adhesion, film continuity and thickness, distensibility, and flexibility.

THE FINDINGS

This work has produced reliable and valuable information. With just four basic coating types, a tremendous variety of products and chemicals can be handled in metal containers. These four include a Unichrome vinyl, phenolic, epoxy and plastisol series of drum linings.

Results in service bear out test cell findings. Unichrome Drum Linings are being specified for such products as acids, alkalies, salts, alcohols, wetting agents and detergents, and many, many others. Drum corrosion and product contamination have been avoided. Shipping costs have been cut.

For important application data and typical usages of these Unichrome Drum Linings, send for Bulletin DL-2.

Plastisol permits spraying of sheet-like coatings

A plastisol developed especially for spraying, Unichrome Coating 5300 applies easily to the exterior of tanks and ducts, and as a lining for equipment. It produces protective films up to 20 mils thick with one coat. Multiple coats can therefore provide thickness equivalent to plastic and rubber sheet materials generally used for protection. Plastisol does a superior job since there are no seams or joints.

Coating 5300 bakes at 350° to 365°F, won't chip, and withstands a wide range of corrosive materials. A number of firms are available that can apply Coating 5300 for any plant without the required baking facilities.

Bulletin VP-1 gives more data on Unichrome Plastisols.

Neoprene for heavy-build maintenance coatings

Several new Ucilon* Coating Systems give chemical engineers unusually effective weapons against corrosion. These systems are based on neoprene coatings for air dry or force dry application. Chief physical characteristic of these systems is the substantial build-up of coating to resist severe service conditions.

In all, 20 chemical resisting Ucilon Coating Systems are now available. Send for Bulletin MC-9 for details.

**Trade Mark*

UNITED CHROMIUM DIVISION
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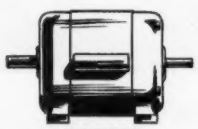
TESTING

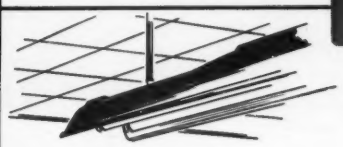
COMMUNICATIONS

CONTROL INSTRUMENTS

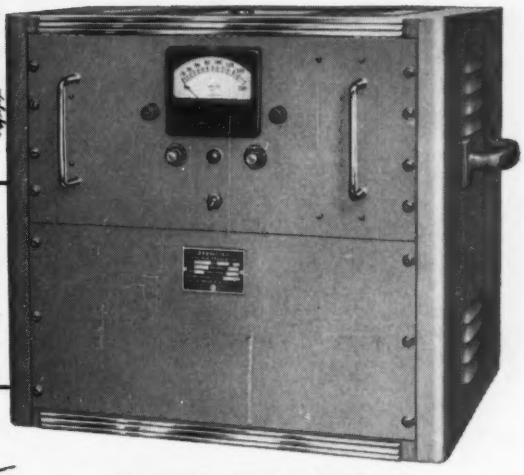
INSPECTION



MOTORS



LIGHTING



ELECTROMECHANICAL (TYPE EM)

For large industrial loads and for applications requiring zero wave form distortion or high efficiency.

STABILINE AUTOMATIC VOLTAGE REGULATORS TYPE EM

Get Zero Wave Form Distortion – with Precise Root Mean Square Voltage Control

When you use *heat, light, sound, power* or *electronic gear,* you need to control voltage to closer limits than it is available commercially.

In thousands of installations the STABILINE Automatic Voltage Regulator type EM has proved itself a rugged "work horse" and an accurate means of maintaining *root mean square* voltage — the rating for which all electrical equipment is designed. Its zero wave form distortion makes it a "must" for many types of electronic equipment. Its efficiency is comparable to fixed-ratio transformers.

STABILINES type EM are available in 115, 230 and 460 ratings for single and three phase duty in capacities up to 100 KVA with correction speeds from .075 to .32 seconds per volt. Send for bulletin for full details.

See Superior Electric's Mobile Display when it is in your area.

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Please send my copy of the STABILINE Bulletin.

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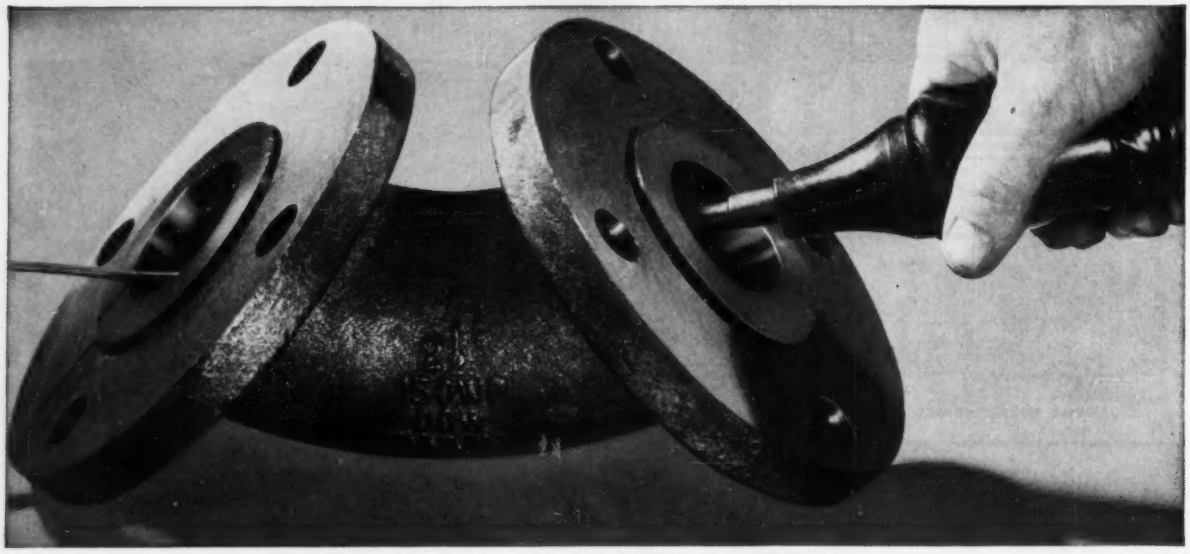
DOW



You can see why

SARAN LINED PIPE

KEEPS SHUTDOWNS TO A MINIMUM

It's made of corrosion-resistant saran pipe swaged into strong, rigid, nonbursting steel. And every piece is spark tested before you buy!

Unscheduled shutdowns are a thing of the past when you use saran lined pipe, fittings and valves to convey corrosive liquids. This modern, trouble-free piping is corrosion resistant . . . forms tight, snug, leakproof joints . . . won't burst under *working* pressures up to 150 psi. And every single piece of saran lined pipe is carefully spark tested by hand to be sure that there are no pinpoint holidays or cracks in its lining. Cast steel lined fittings are available for higher pressures.

Installation costs are surprisingly low with saran lined pipes, fittings and valves, too. They can be cut and threaded in the field with standard pipe-fitter's tools. Their rigidity means few supporting members are needed.

If you want to convey acids, alkalies, or other corrosive liquids at low over-all cost, be sure to investigate saran lined pipe. Contact the Saran Lined Pipe Company, 2415 Burdette Avenue, Ferndale 20, Michigan, Department SP528A-2.

RELATED SARAN PRODUCTS

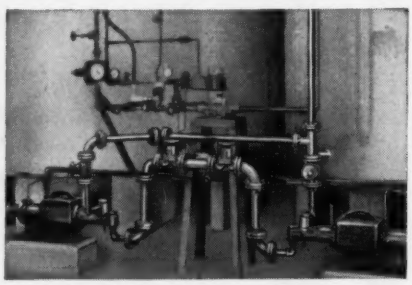
Tank lining • Saran rubber molding stock • Saran tubing and fittings • Saran pipe and fittings.

SOME OF THE MANY INSTALLATIONS USING

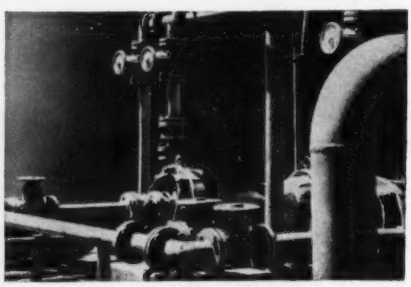
SARAN LINED

STEEL PIPE

Saran Lined Pipe is Manufactured by The Dow Chemical Company Midland, Michigan



A large Southeastern paper mill uses saran lined pipe to handle corrosive alum solution. It has proved to be an exceptionally satisfactory answer to eliminating unscheduled shutdowns.



This installation of a large Midwest company has conveyed highly corrosive hydrochloric acid for over seven years. The joints have remained as tight and leakproof as new.

you can depend on DOW PLASTICS DOW

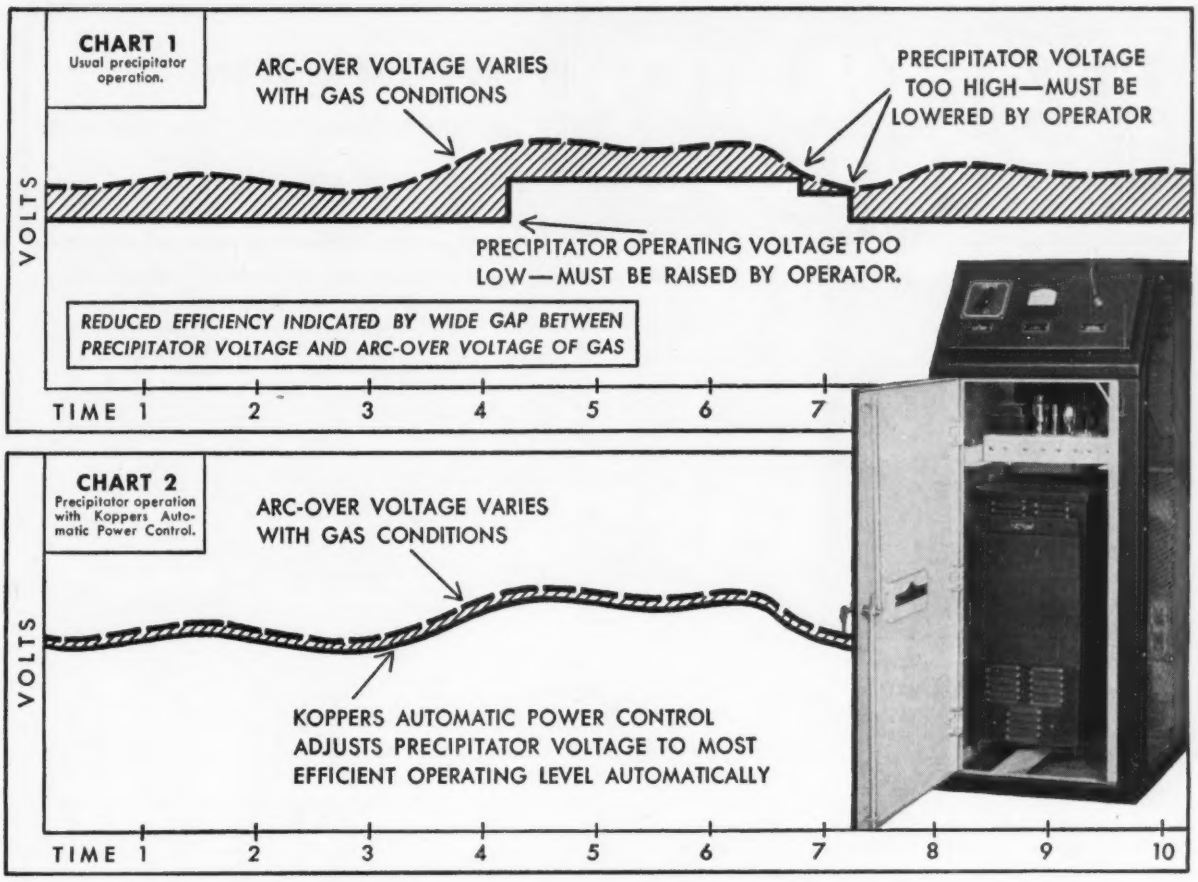


CHART 1
Usual precipitator operation.
ARC-OVER VOLTAGE VARIES WITH GAS CONDITIONS
PRECIPITATOR VOLTAGE TOO HIGH—MUST BE LOWERED BY OPERATOR
VOLTS
PRECIPITATOR OPERATING VOLTAGE TOO LOW—MUST BE RAISED BY OPERATOR.
REDUCED EFFICIENCY INDICATED BY WIDE GAP BETWEEN PRECIPITATOR VOLTAGE AND ARC-OVER VOLTAGE OF GAS
TIME 1 2 3 4 5 6 7
CHART 2
Precipitator operation with Koppers Automatic Power Control.
ARC-OVER VOLTAGE VARIES WITH GAS CONDITIONS
VOLTS
KOPPERS AUTOMATIC POWER CONTROL ADJUSTS PRECIPITATOR VOLTAGE TO MOST EFFICIENT OPERATING LEVEL AUTOMATICALLY
TIME 1 2 3 4 5 6 7 8 9 10

New Koppers Power Control automatically insures maximum Electrostatic Precipitator efficiency

Now Koppers enables you to get *peak* gas cleaning efficiency from your electrostatic precipitator at a minimum of operating maintenance—with the new Koppers Automatic Power Control.

This compact, cabinet unit utilizes electronic controls to automatically maintain the proper voltage to best ionize the gas. As gas conditions vary —an occurrence even under the most constant industrial operations—it automatically adjusts the voltages to the most efficient level for solids removal. This reduces wasteful "sparkover" and enables the precipitator to operate continually at peak efficiency voltage without frequent "trip-outs."

What is more, the new Koppers Automatic Power Control eliminates the need for constant personal attendance. Completely self-contained, easy to install, it quickly repays initial cost with savings in man-hours and operating efficiency.

The new Koppers Automatic Power Control is another engineering advance in a series that has won industry-wide confidence for Koppers Electrostatic Precipitators. Keep Koppers' ability to serve *you* in mind. For information or assistance in solving your gas cleaning problem, send this coupon.

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METAL PRODUCTS DIVISION • KOPPERS COMPANY, INC. • BALTIMORE 3, MD. This Koppers Division also supplies industry with Fast's Couplings, American Hammered Industrial Piston and Sealing Rings, Aeromaster Fans, Gas Apparatus.

Engineered* Products Sold with *Service

ELECTROSTATIC PRECIPITATORS

KOPPERS COMPANY, INC., *Electrostatic Precipitator Dept.*, 311 Scott St., Baltimore 3, Md.

☐ I am interested in how the new Koppers Electrostatic Precipitator Automatic Power Control can help me to more efficiency and greater savings in gas cleaning.

☐ I am interested in an analysis and recommendations for my operation. I understand I am under no obligation.

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EVAPORATOR CONTROL

One of a series of basic instrumentation recommendations for the unit operations

GEORGE E. HOWARD, Manager
Application Engineering Dept.

"The success of the Taylor approach to evaporator control is due to our engineers' knowledge of how an evaporator works and the problems involved. This experience has been gained through years of working with widely diversified industries. Data sheets on this and other evaporator problems are available on request."

PROBLEM

To operate the evaporator to produce a uniform product of the optimum concentration at the lowest possible cost. And with a minimum of operator attention and maintenance.

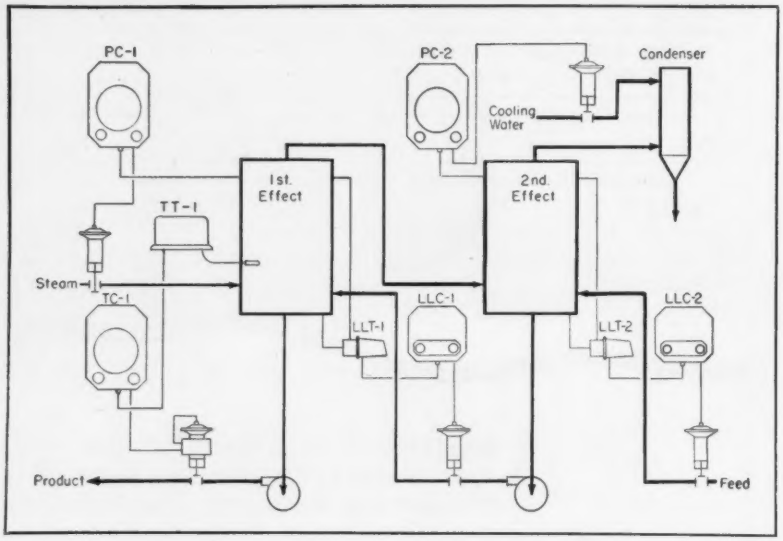
SOLUTION

(*see diagram*) On body #1 the FULSCOPE* Pressure Controller (PC-1) insures stable pressure conditions in the body, despite steam supply variations, fouling of tubes or changes in product rate. It also provides a record for correlation with solution temperature.

The TRANSAIRE* Transmitter (TT-1) senses boiling temperature as a measure of concentration, since pressure is maintained precisely. SPEED-ACT* in the measuring circuit insures practically instantaneous response.

The Temperature Controller (TC-1) records and controls boiling temperature and regulates discharge rate to maintain precisely the desired concentration.

*Trade Mark



The Level Controllers (LLC-1 and 2) maintain flow of the solution through the evaporator in proper relation to the discharge rate. They insure optimum use of the heating surface and considerably reduce tube fouling.

Piping costs and maintenance can be minimized by using Differential Pressure Transmitters (LLT-1 and 2) close coupled at the point of measurement. Yet the receiving level controllers can be located at a convenient centralized spot. Where purges are necessary, the double process connections on the DP Transmitter permit the meter body as well as the lines to be purged.

The Pressure Controller (PC-2) measures and controls absolute pressure (corrected for barometric pressure) in the final effect by regulating flow of cooling water to the condenser. This assures stable operation, despite variations in cooling water pressure or temperature or fouling of tubes in the 2nd effect. In cases where cooling water supply is limited, it conserves condenser water requirements by maintaining the minimum quantity necessary for best operating conditions.

Evaporator rate may be changed easily with a minimum of upset to concentration control, simply by adjusting the control point of PC-2.

SUMMARY OF BENEFITS

A control system such as this will pay for itself in a short time by:—

1. Prolonging the period between clean-ups.

2. Insuring steady output of uniform product, even with erratic supply.

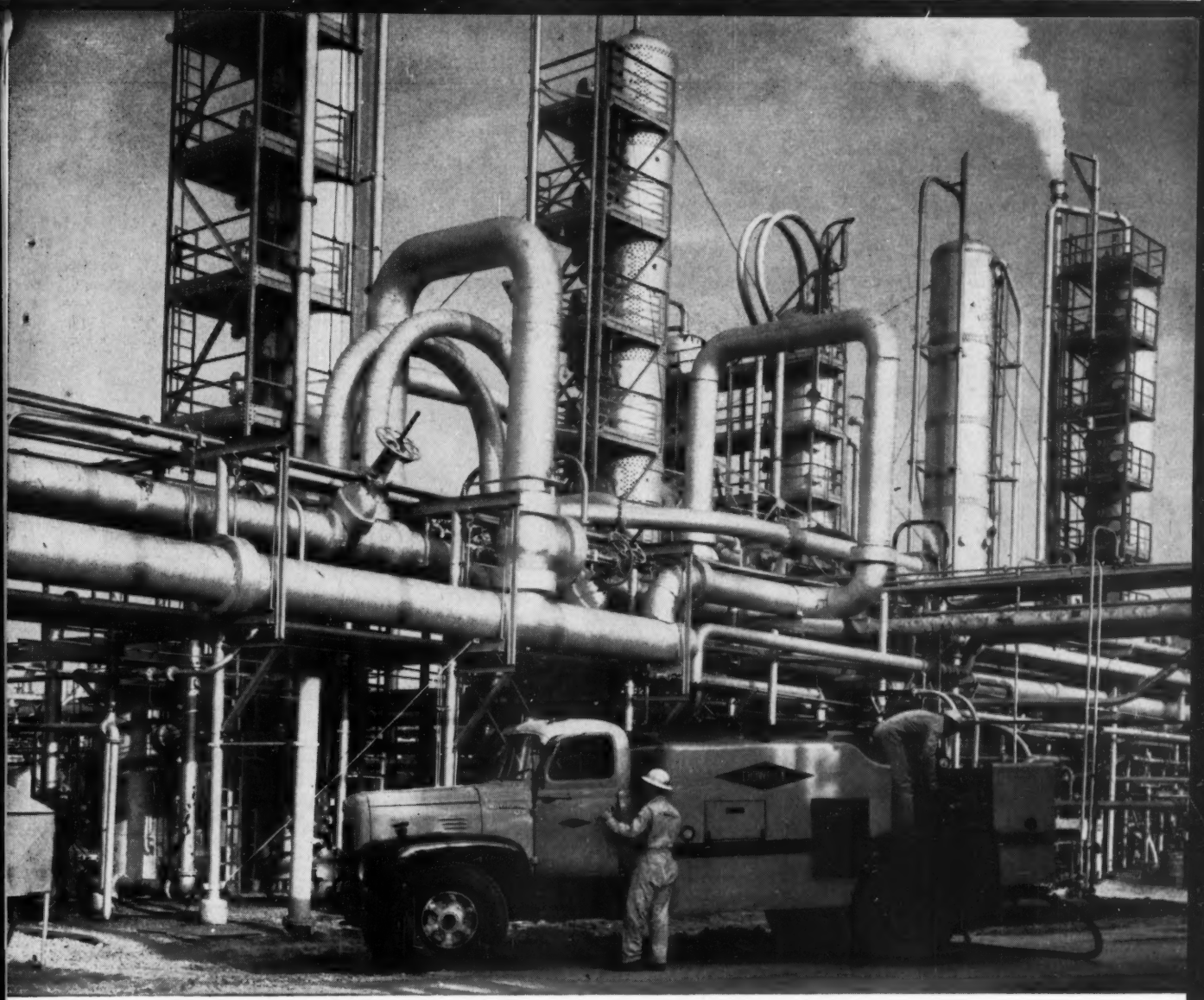
3. Maintaining steady steam demand.

4. Cutting operator attention time to routine observation, thus releasing trained personnel for more productive duties.

• • •

Send for Data Sheet #10 covering the recommended instrumentation for multiple effect evaporators in greater detail. And remember, whatever your problem in instrumentation, Taylor Field Engineers are ready, willing and able to serve you. Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.

Taylor Instruments MEAN ACCURACY FIRST



SIX DAYS OF DOWNTIME SAVED

Refinery tower cleaned chemically by Dowell in only eight hours . . . a six-day saving over mechanical methods!

A refinery operator had to shut down his H_2S stripper bubble cap tower every two months to remove an oily carbonate scale. Each shutdown took seven days, because of the mechanical cleaning methods used, and even then the tower was not thoroughly cleaned.

Dowell engineers were asked to tackle the problem. They cleaned the tower in just eight hours, using chemical solvents. Visual inspection showed the tower to be free of scale with all loose deposits washed from the caps and trays. The operator of this refinery was so impressed that he adopted a regular schedule of Dowell chemical cleaning.

Dowell chemical cleaning methods are designed to reduce costly downtime, because solvents are introduced through regular connections, keeping dismantling at a minimum. Liquid solvents can go wherever gases or condensates flow —to clean angles, bends and other irregular surfaces inaccessible to mechanical methods.

You can help to maintain maximum operating efficiency in your plant by arranging for a regular program of Dowell chemical cleaning. For full information, call your nearest Dowell office, or write Dowell Incorporated, Tulsa 1, Oklahoma, Department K-33.

chemical cleaning service for industry

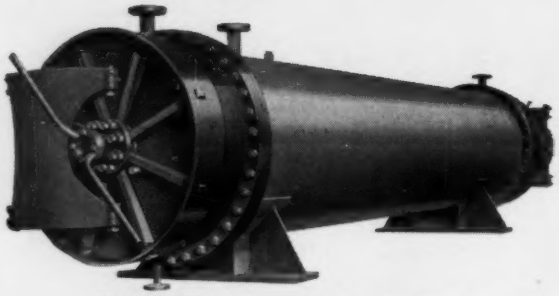
DOWELL

A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY

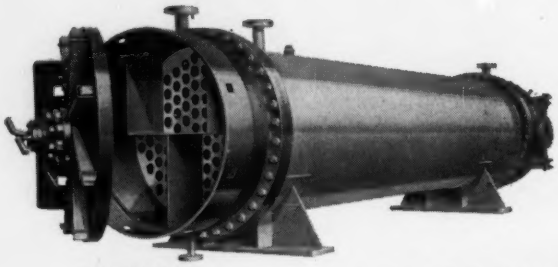
Heat Exchangers Open in 5 Seconds

with new p-k Lever-Lock Door*

Substantial savings seen for processors of high-fouling liquids and others who must clean and inspect heat exchangers regularly.



CLOSED, the Lever-Lock looks like this. A single 1/6th turn of the lever draws back the lock bars.



OPENED manually with an easy pull, the tubes and tube sheet are easily accessible.

Anyone who has had to open a heat exchanger knows how time-consuming and costly it can be. Dozens of bolts must be loosened. Specialized labor is often required.

Now these problems can be things of the past. **p-k**'s Lever-Lock Door, available on **p-k** heat exchangers, provides *five-second access* to the unit—and a new approach to exchanger design. The door "unlocks" with a 60° manual turn of a lever. In horizontal position the door then swings open easily. In vertical position, it is lifted by means of a pneumatic cylinder. Either way, it seats itself automatically on a long-life, self-sealing gasket. Other features allow Lever-Lock to be used in a wide range of applications:

- **Available in all alloys**
- **Pressure range from full vacuum to 300 psi**
- **Temperatures to 400°F. (Special alloys for sub-zero applications)**
- **Mechanical lock available to prevent opening vessel when pressurized**
- **No maintenance other than simple lubrication**
- **Available in diameters from 16" through 36"**

Lever-Lock doors have been used successfully not only on **p-k** heat exchangers, but on **p-k** autoclaves and sterilizers in the chemical, textile, food processing, and rubber manufacturing industries as well. For all of them, and wherever exchangers carry high-fouling liquids or require frequent entry for cleaning and inspection, Lever-Lock doors pay for themselves through savings in time. Heat transfer can be more efficient, too, since you can afford to remove gunk more frequently.

But this is only part of the story. If you see the Lever-Lock as the answer to a perplexing problem in your plant, why not write for *all* the facts, *today?*

The Patterson-Kelley Co., Inc., 210 Lackawanna Avenue, East Stroudsburg, Pa., and principal cities

*Pat. Pending

1. This autoclave is in vertical position with its Lever-Lock Door equipped with a pneumatic cylinder.

2. To open, operator merely gives lever a 1/6th turn that releases lock bars.

3. Door is lifted in 5 seconds—automatically! An hour or more of work is saved.

Write for new **p-k** Bulletin No. 2030 for full details.

PATTERSON-KELLEY

2575

Offices: 101 Park Avenue, New York 17 • Railway Exchange Building, Chicago 4 • 1700 Walnut Street, Philadelphia 3 • 96-A Huntington Avenue, Boston 16 and other principal cities

TUBE LIFE TRIPLED...with SELAS

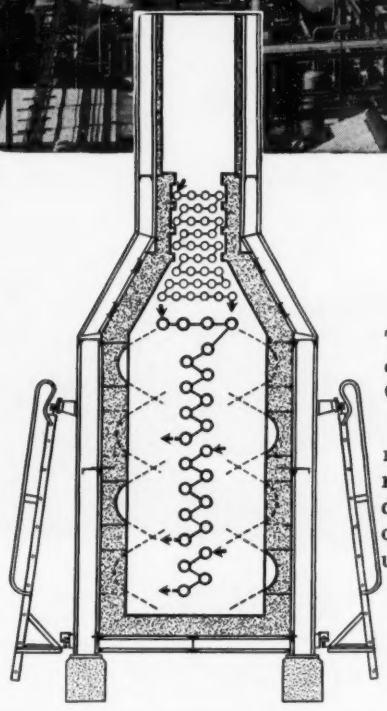


Photo Courtesy Westvaco Chlor-Alkali Div., Food Machinery and Chemical Corp.

IN CONTINUOUS PRODUCTION OF CARBON BISULFIDE AT WESTVACO

Tubes in Selas Gradiation reactor heaters, with Zone Control, have exceeded life expectations by three times at the modern Westvaco plant in So. Charleston, W. Va., which produces carbon bisulfide from methane sulfur.

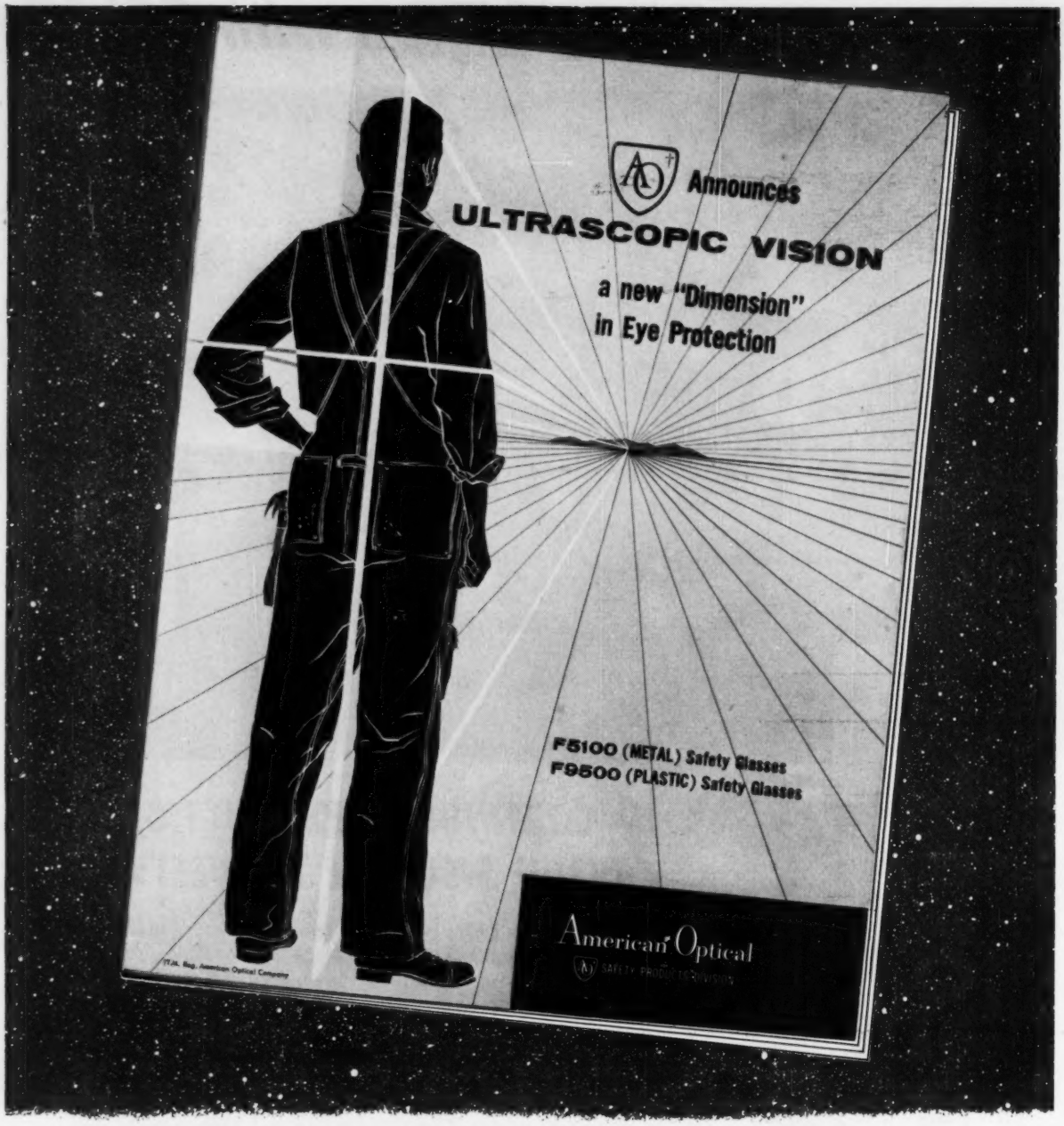
The precise Zone Control of Selas Gradiation heaters is achieved by manifolding fuel gas in such a manner that the flow to each horizontal row of burners can be adjusted to the necessary level to maintain a predetermined tube wall temperature. Tube wall temperature remains constant over the entire radiant coil length and the fluid temperature is brought up to the precise degree of heat required in each zone. Results are:

- Prolonged tube life . . . uniform heat along and around tubes . . . minimizes corrosion rate because of lower maximum tube wall temperatures.
- Flexibility in determining and meeting shape of heating curve.
- Multiple coils can be installed with absolute temperature control in a single radiant chamber. (Westvaco installation has four coils.)

Bulletin, "Gradiation Heating for Petroleum and Chemical Processing" shows the use of Zone Control in numerous continuous processing applications. Send for your copy today.

SELAS
CORPORATION OF AMERICA
PHILADELPHIA 34, PENNSYLVANIA

FLUID PROCESSING



To All Concerned with Industrial Safety:

Did you get your copy of AO's NEW Brochure on the "1956" Line of Ultrascopic Safety Glasses? Be sure to get it . . . these evolutionary products will make your protection job easier.

Write to:

American Optical

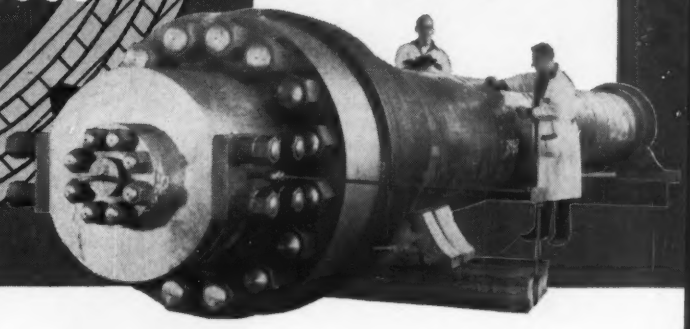
SAFETY PRODUCTS DIVISION
SOUTHBRIDGE, MASSACHUSETTS • BRANCHES IN PRINCIPAL CITIES

Always insist on the AO† Trademark on Lenses and Frames

†T.M. Reg. by American Optical Company

CYLINDRICAL SANDWICH OF STEEL...

A MULTI-LAYER PRESSURE VESSEL is built up from concentric layers of relatively thin steel plate progressively wrapped, tightened and welded together around an inner, pressure-tight cylinder. Inner layer is made like any solid wall vessel. This highly efficient, patented construction makes possible economies—*with safety and flexibility of design*—in heavy-wall vessels intended for use at extremely high pressures. United States Steel helped the manufacturer develop a special steel for these Multi-layer vessels.



saves money on heavy-wall, high-pressure vessels

With its ingenious Multi-layer pressure vessels, A. O. Smith Corporation opens up almost unlimited possibilities to the design engineer for commercial-size vessels for unusually high pressures—from 7500 to 30,000 psi. Instead of using hard-to-fabricate, heavy-gauge plates, A. O. Smith builds up the thick walls of these vessels with multiple layers of thin steel. As a result, welding conditions are improved and stress relief is not needed. Consequently, Multi-layer fabrication of heavy wall cylinders is more economical.

USS METALLURGICAL SERVICE HELPED SOLVE THE PROBLEM

When A. O. Smith engineers first conceived Multi-layer construction, process pressures were within limitations of standard A.S.T.M. steel strengths. However, as pressure demands increased, A. O. Smith needed a new and very special steel. And that is where United States Steel came to their aid. We helped them develop a high-tensile, high-yield strength, low-alloy plate steel with a minimum ultimate strength of 105,000 psi., a minimum yield strength of 70,000 psi., and good weldability.

HELP FOR YOU

When you have any sort of steel problem, let USS metallurgists help you with it—whether you need a special steel or just want to be sure you have the *very best* of the standard AISI analyses for your job. Phone our nearest district sales office. Or write United States Steel, Room 4987, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

See The United States Steel Hour. It's a full-hour TV program presented every other week by United States Steel. Consult your local newspaper for time and station.

UNITED STATES STEEL CORPORATION, PITTSBURGH • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. • UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

Carilloy USS Steels

5-2213

ELECTRIC FURNACE OR OPEN HEARTH

COMPLETE PRODUCTION FACILITIES IN CHICAGO OR PITTSBURGH

UNITED STATES STEEL

Only Chapman Tilting Disc Check Valves give you

FAST TIGHT QUIET CLOSURE

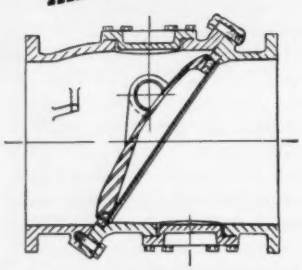
Fast, quiet operation means low cost operation for check valves. That's exactly what the Chapman Tilting Disc Check Valve is designed to do. It won't flutter or slam and damage the piping joints or the valve itself. The unique drop-tight closure action eliminates scraping and wear of the disc and seat.

Rugged construction and low wear of the Chapman Tilting Disc Check Valves mean long life under severe operating conditions. Absence of vibration plus low head loss keep maintenance of the entire piping system at a minimum.

Whether for replacement or for new piping systems, be sure to specify Chapman Tilting Disc Check Valves. They're available in iron and steel for handling fluids or gases under a wide range of pressures. For full data on the complete line, write today. Ask for Catalog 30-A.

The Chapman Valve Mfg. Co.
INDIAN ORCHARD, MASSACHUSETTS

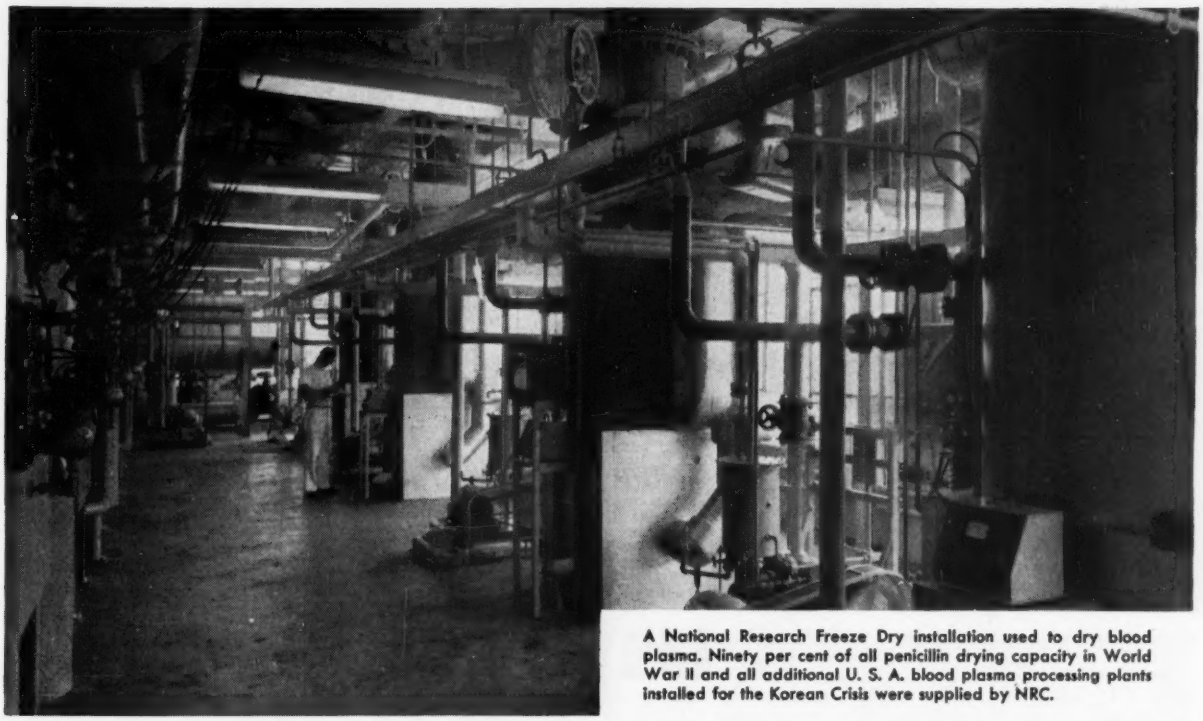
Here's why Chapman's Tilting Disc Check Valves Keep Quiet All of Their Lives



This specially designed "airfoil" disc balances perfectly in open position. The fluid holds the disc tightly against its stops without flutter. The body of the valve is larger around the disc, so the net valve area is at least as much as the pipe area to assure low flow resistance.

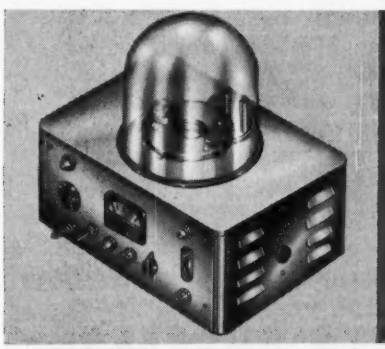
When the flow is reversed, pressure against the upper part of the disc cushions it as it closes. Then the disc drops easily and tightly to its beveled seat after the valve has swung closed. Seating is fast and quiet with minimum head loss in all but unusual piping arrangements.

From the Maker of the World's Largest Freeze Dry Systems

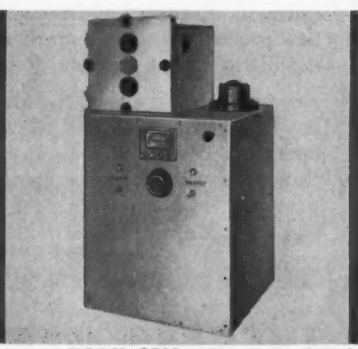


A National Research Freeze Dry installation used to dry blood plasma. Ninety per cent of all penicillin drying capacity in World War II and all additional U. S. A. blood plasma processing plants installed for the Korean Crisis were supplied by NRC.

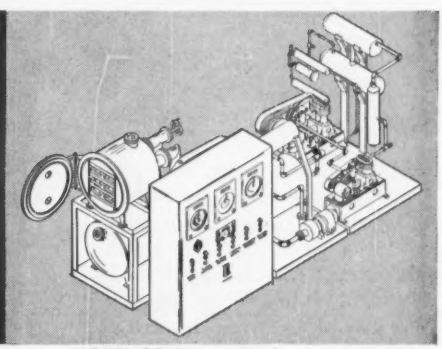
A New Line of Freeze Dry Units with New Efficiency...Ease of Operation



MODEL 3505 is a laboratory size unit that eliminates the need for night-shift operators. It runs unattended because there is no cold trap requiring replenishment with dry ice. Self-contained, rugged, and compact, it can be stored out of the way when not in use. Set-up is easy; just plug into 115 volt A.C. circuit.



MODEL 3501, with a capacity of 1850 milliliters of water, is used for limited volume production . . . or as a pilot plant to determine optimum drying cycles. Unusually easy to operate, it is a complete unit and like the 3505 does not require water connections.



MODEL 3506 is an ideal supplement to a large scale freeze dry plant. It automatically records time-temperature curves for determination of optimum drying cycle. A cam cut from the appropriate curve controls the production equipment to reproduce exactly the optimum cycle. Equipped for automatic operation, it can also be used — unattended — for limited scale production.

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Please send me Data Sheets on
Model 3505 ☐ Model 3501 ☐ Model 3506 ☐
Please have representative call ☐

Name.....Title.....
Company.....
Address.....
City.....Zone.....State.....

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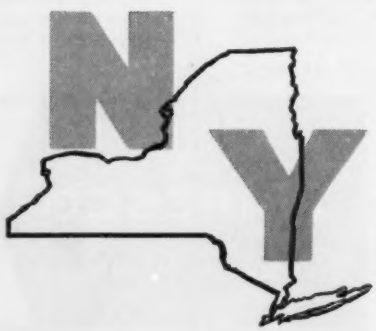
SUCCESS BEGETS SUCCESS



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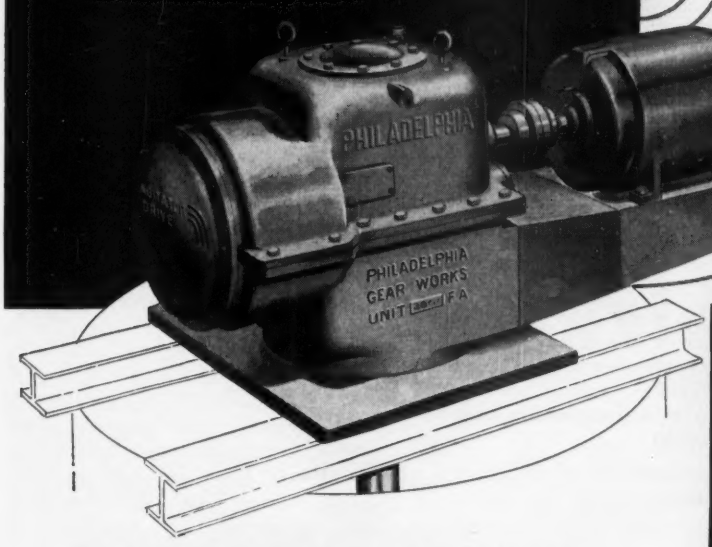
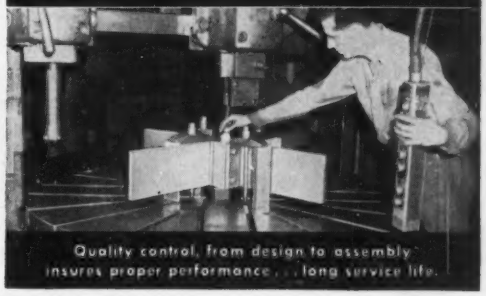


Philadelphia Gear Works is proud to offer a new line of packaged fluid agitators . . . plus complete fluid agitation engineering service . . . plus field service —right in your plant—covering every phase of your particular fluid agitation applications. Our engineers are prepared to specify agitation to best meet your process requirements. As you know, Phillie Gear reducers for agitator drives have been meeting the most exacting standards of major processors for many years. We have the answers to your agitation problems. Let us assume the responsibility for every phase of your fluid agitator installations.

Complete production facilities assure prompt delivery . . . even with special agitator designs

Phillie Gear manufactures every major component of the agitators, except motors and bearings.



Quality control, from design to assembly insures proper performance . . . long service life.

See our new agitator drive in action at the CHEM SHOW Dec. 5-9, Philadelphia Convention Hall, BOOTH 33.

SEND FOR ILLUSTRATED BULLETIN DESCRIBING NEW PACKAGED AGITATOR DRIVES.

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Established 1892

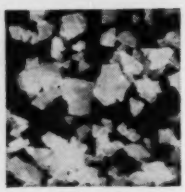
BRIEFS for buyers of

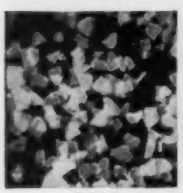
Sodium Sulfide
Sodium Sulfhydrate
Flake Caustic Soda

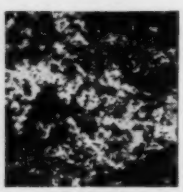
Especially good for repackaging (as in cleansers and other specialties) are these four sizes of Hooker flake caustic soda, all shown actual size.

"Regular," "fine," and "crystal" sizes are nondusting. And with these flakes, you're sure of actually *getting* the size you order. In a tightly-controlled flaking-screening operation, we make the flakes just thick enough to stand up well and stay the same size in transit.

Regular


Fine


Crystal


Powdered

Regular flake is shipped in 100-lb. and 400-lb. steel drums; the other sizes in 450-lb. steel drums. The larger drums come in two styles: 14-inch opening (extra large for easy emptying), or full open head (at slight extra cost).

For data sheet, check the coupon. For test samples, just write and tell us the sizes you'd like.

A tanner could tell you what can happen when sodium sulfide picks up iron.

When this happens in a tannery, the leather is likely to develop blue blotches.

The five steps we take to help *tanners* avoid this situation hold meaning for *you*, if you process with sodium sulfide.

1. We use only our own caustic soda in making sulfide. This gives us close control of its composition.
2. We never re-use a sulfide drum. You receive every shipment in brand new containers.
3. Every drum is lacquer-lined to prevent iron contamination.
4. Six sturdy lugs hold the drum lid tight during handling and storage. They're handy for re-sealing the drum, too.
5. We individually lacquer the lid of every drum, to make an airtight seal that keeps the product at full strength.

The clean, strong flakes dissolve right into process, even without stirring. No waiting; no decanting.

You've probably gathered by now that sodium sulfide, at Hooker, is a specialty of the house. You're right. And that's a good reason why you stand to get maximum satisfaction with ours.

The flake form is shipped in 90-lb. and 350-lb. drums. Solid form comes in 625-lb. drums. Why not order a trial quantity?

Better pH control

What we said about sulfides also goes for Hooker *sodium sulfhydrate*, with this important difference:

Some processors are switching to our sulfhydrate, as a replacement for sodium sulfide. Why?

When sulfhydrate goes into solution, it forms less caustic soda than does sodium sulfide. Only half as much, in fact. So these processors are able to get more sulfidity, with less alkalinity, by using sulfhydrate. Maybe there's an idea here for your processing operations, if high pH is a problem in sulfide solutions.

Hooker sodium sulfhydrate dissolves rapidly, even in cold water. There's virtually no sedimentation even after long standing. You can get it in 90-lb. and 350-lb. drums. For more details, check the coupon.

For Technical Data Sheets

on Hooker chemicals mentioned on this page, check here:

- ☐ Sodium Sulfide
- ☐ Sodium Sulfhydrate
- ☐ Caustic Soda

How up-to-date is your caustic data file? If you're a user of liquid caustic soda, here's some recent material to help you buy better:

- ☐ Caustic Soda Buyer's Guide. Pocket-size booklet lists advantages of 73% and 50% caustic concentrations; comparative costs; includes nomograph for figuring savings with 73%.

Clip and mail today with your name, title, company address.

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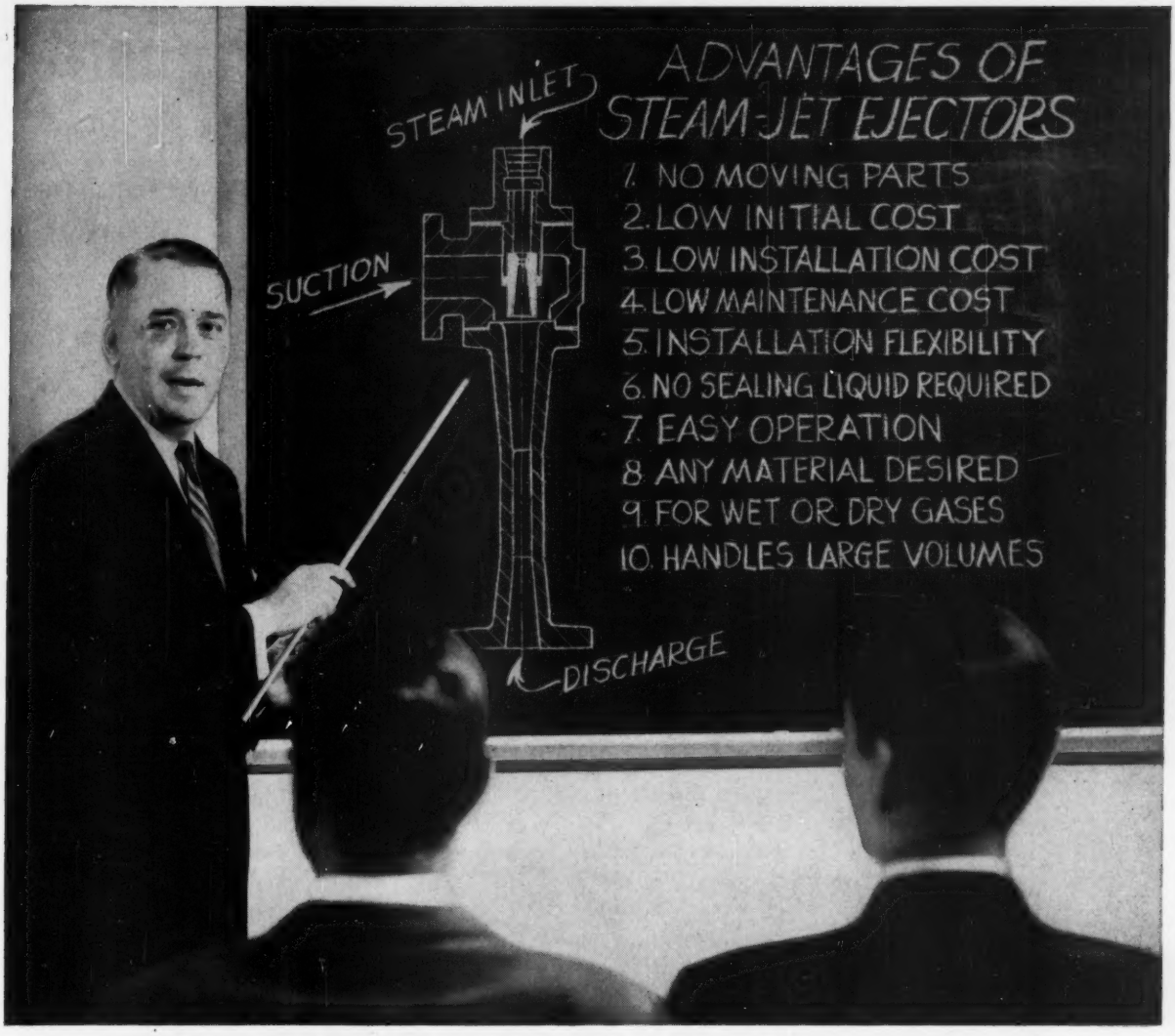

Frank R. Hommowun, Sales Manager of Worthington's Steam-Jet Ejector Section, tells . . .

how to pull a vacuum for pennies

Wherever there's a steam source, there's no cheaper way to obtain process vacuum than with a standard Worthington steam-jet ejector.

Here's how you save:

Low initial cost—Consists of only a few simple parts—no driver required.

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Low maintenance costs—No moving parts to wear or misalign.

Easy operation—No control required—just turn on and off.

Easy selection—For single and two-stage ejectors, that's taken care of by our new 60-page "Steam-Jet Ejector Application Handbook." Ask for bulletin W-205-E21 on your company letterhead. And if yours is a special application calling for the 3-, 4-, or 5-stage ejectors or special materials—any machineable metal, porcelain, impervious graphite—we can take care of that, too. Write Worthington Corporation, Steam Power Division, Section S.5.4, Harrison, N. J. S.5.4

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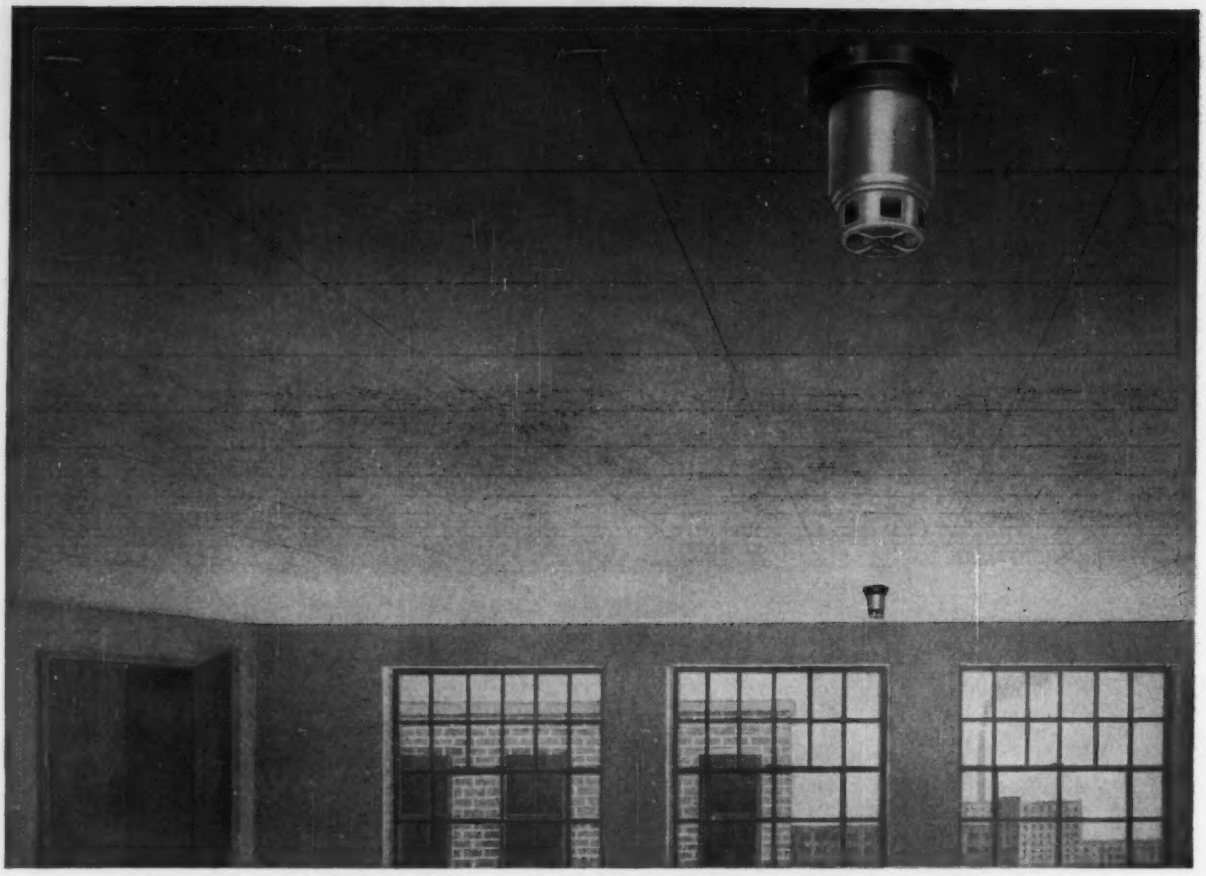
Steam-Jet Ejectors • Gas Compressors • Chemical Pumps • Industrial Mixers • Refrigeration

New, radio-active, automatic fire guard!

C-O-TWO PRE-DETECTOR SYSTEM



Each pre-detector head protects up to 3,600 square feet of area... harmless radio-active element utilizing ionization chamber principle quickly detects all forms of fire... requires only simple two-wire circuit and insignificant wall space for controls.

This completely new and positive means of spotting fire is just what you've always needed and wanted . . . detects in the earliest stage, invisible combustion gases, visible smoke, slow smoldering, as well as open flame. The C-O-TWO Pre-Detector System is simple to install, extremely economical to maintain and doesn't depend on thick smoke or heat for actuation.

As many pre-detector heads as necessary can be connected together in a single circuit and up to 16 separate circuits or spaces handled by one system. With a single circuit the pre-detector heads are connected directly to the fire indicating cabinet, while with multiple circuits the pre-detector heads are first connected to one or more space indicating cabinets capable of visually showing by number the exact location of the fire. Relays perform such functions as sounding alarms, closing fire doors, shutting down ventilation and releasing fire extinguishing systems.

The C-O-TWO Pre-Detector System has been subjected to extensive testing and carries Underwriters' Laboratories, Inc. listing, as well as Factory Mutual Laboratories approval. Proven pilot installations have been made in such diversified properties as a television station, an electric power company network analyzer room, a railroad signal tower, an airline flight training equipment room and the offices of an insurance company.

Don't take unnecessary chances any longer . . . the extensive fire protection experience of PYRENE—C-O-TWO over the years is at your disposal without obligation. Get complete facts about this new C-O-TWO Pre-Detector System today!

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portable fire extinguishers . . . built-in fire detecting and fire extinguishing systems

CARBON DIOXIDE • DRY CHEMICAL • VAPORIZING LIQUID • SODA-ACID • WATER • CHEMICAL FOAM • AIR FOAM

Material: Activator solution—water with 5% ferro-sulphate. **Problem:** Short service life of turbine pumps; sometimes only two weeks. **Solution:** First Moyno ran 6 months without a breakdown. Using relief valves, pressure is kept at constant 120 p.s.i. Now using 7 Moynos because of this exceptional service.	**Material:** Anti-scale boiler treatment. (Alcohols, oils, anti-foam agents, sludge conditioners.) **Problem:** Frequent pump breakdowns caused by back pressure of spray nozzles; and abrasion. **Solution:** Moyno pumps cut pumping time from 20 minutes to 3, reduced down-time, increased production 200%!	**Material:** Caustic solution—for use in mercerizing machines. **Problem:** Rotary pumps wore quickly; lost capacity, and did not have enough suction. **Solution:** Moyno pumps cut maintenance and repairs to minimum—had ample suction for drawing caustic through the cloth.
Material: 40° copperas crystals in 20% sulphuric acid. **Problem:** Low production of diaphragm pump. **Solution:** Moyno pump handles an increased percentage of solids, which in turn increases production.	**Material:** Calcium carbonate slurry. **Problem:** Continuous failures of centrifugal pumps. **Solution:** Moyno pump still giving perfect service after 1½ years. Service is practically continuous—with pump in operation 24 hours per day.	**Material:** Size—containing china clay and latex. **Problem:** Centrifugals unable to handle viscosity—causing frequent trouble. **Solution:** Moyno pump has been on duty for a year. Pump trouble completely eliminated; no repairs required.

Six Chemicals-Handling Problems... Solved by the MOYNO® PUMP!

Features of the MOYNO that may solve YOUR pumping problem

Positive Displacement—Moynos are available to pull up to 29" vacuum while discharging under pressure. Big Moynos deliver up to 250 g.p.m. at pressures to 600 p.s.i.

Gentle—No churning; won't break up semi-solids; won't aerate liquids.

Reversible—The Moyno pumps with equal efficiency in either direction.

Versatile—handles liquids, abrasive slurries, pastes—even potato salad! Rotor and stator are available in stainless steel, other alloys or plastic to meet a wide variety of applications.

Trouble-Free—self-priming; won't cavitate or vapor-lock. Just one moving part—no valves to stick, no pistons to gum up. Built for tough service. Easy to maintain.

Looking for a pump with a fast-growing reputation for solving tough pumping problems? Then take a look at the simple, versatile Moyno!

Briefly described above are a few of the many successful case histories proving how Moynos handle jobs where other pumps fail. Why is the Moyno a "problem-solving" pump? For one thing, because it differs completely from conventional pumps . . . rotary, centrifugal or piston. Just one rugged moving part—a rotor turning within a stator—does the job.

The list of chemicals handled by Moynos gets longer every day. If *you* have a pumping problem, such as handling abrasive slurries, mild acids, caustics—watery, viscous or even semi-solid—find out if the Moyno can help you! Use the coupon below for prompt, complete information. Come and see us in Booth 32, at Chemical Industries Show, Philadelphia, Dec. 5-9.

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Gentlemen: Please mail free copy of Bulletin 30-B containing details on construction and operation of Moyno Pumps:

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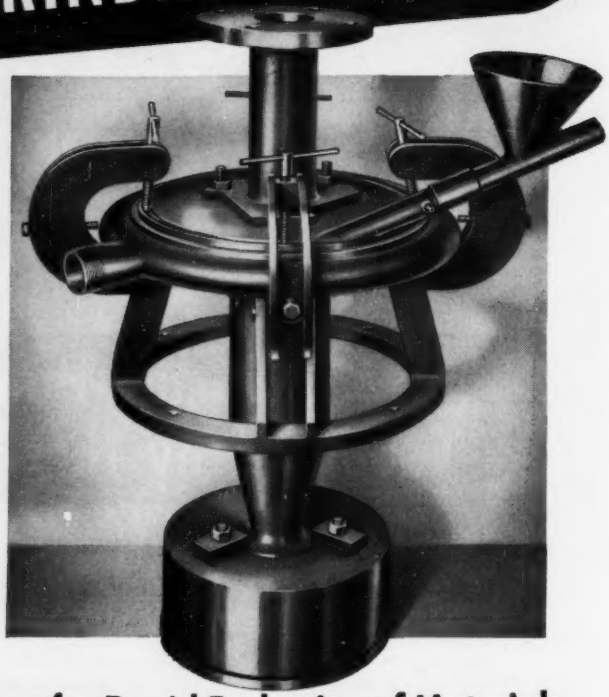
Sturtevant MICRONIZER* GRINDING MACHINE



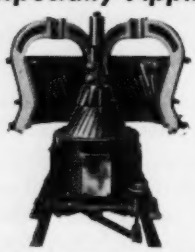
Reduces Solids to Micron Sizes

The new Sturtevant *Micronizer* grinding machine is a fluid jet grinder especially designed to reduce solid materials to particle sizes in the micron ranges.

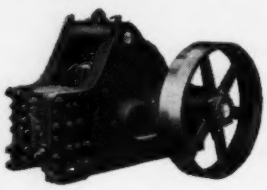
Sturtevant *Micronizers* are used for simultaneous dry grinding and classification of solids. The variety of materials that can be processed is large and includes both metallic and non-metallic minerals and ores, metals, pigments, insecticides, fungicides, pharmaceuticals, plastics, dyes and numerous other organic and inorganic products. Available in capacities from ½ to 3000 pounds per hour.

Other Sturtevant Pulverizing Equipment for Rapid Reduction of Materials...

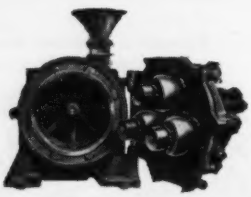
Especially Applicable for Initial Grinding of Products for the Micronizer Mill



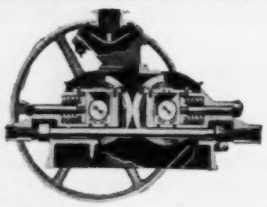
ROTARY FINE CRUSHERS for intermediate and fine reduction (down to ¼"). Open door accessibility. Soft or moderately hard materials. Efficient granulators. Excellent preliminary Crushers preceding Pulverizers.



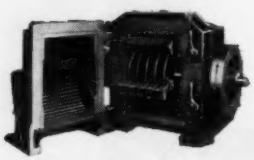
JAW CRUSHERS for coarse, intermediate and fine reduction of hard or soft substances. Heavy or light duty. Cam and Roller action. Special crushers for Ferro-alloys. Several types, many sizes.



RING-ROLL MILLS for medium and fine reduction (10 to 200 mesh), hard or soft materials. Very durable, small power. Operated in closed circuit with Screen or Air Separator. Open door accessibility. Many sizes. No scrapers, plows, pushers, or shields.



CRUSHING ROLLS for granulation, coarse or fine, hard or soft materials. Automatic adjustments. Crushing shocks balanced. For dry or wet reduction. Sizes 8 x 5 to 38 x 20. The standard for abrasives.



SWING-SLEDGE MILLS for coarse and medium reduction (down to 20 mesh). Open door accessibility. Soft, moderately hard, tough or fibrous substances. Built in several types and many sizes.

AIR SEPARATOR for separation of fines to 325 mesh and finer. Increases output from 25% to 300%... lowers power costs by 50%. Capacities ¼ to 50 tons per hour output.

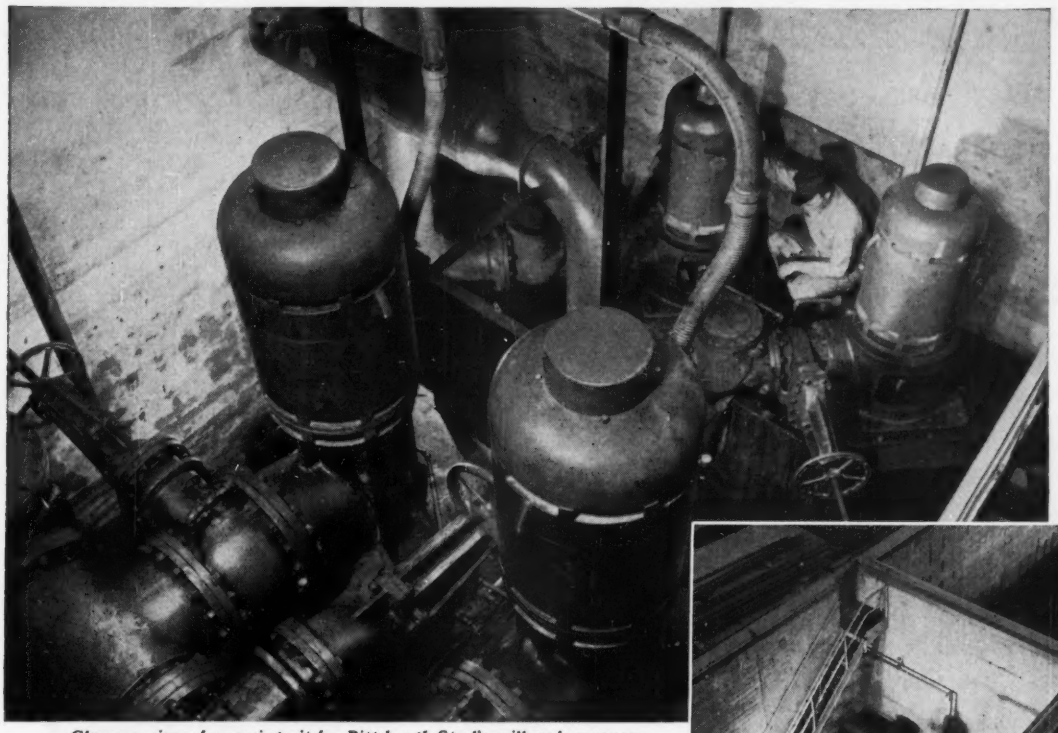
*Registered trademark of the Sturtevant Mill Company

STURTEVANT MILL COMPANY

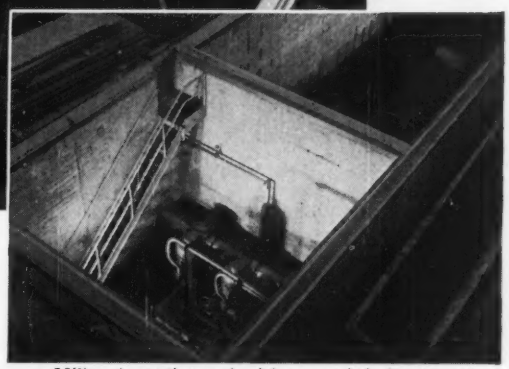
100 CLAYTON STREET, BOSTON 22, MASS.

DESIGNERS & MANUFACTURERS OF DENS AND EXCAVATORS • MIXERS • SCREENS • PULVERIZERS • ELEVATORS • AND COMPLETE FERTILIZER UNITS

I-R VERTICAL PUMPS STAND UP
under tough corrosive and abrasive conditions in
MILL-SCALE RECOVERY SYSTEM



Close-up view of pumping pit for Pittsburgh Steel's mill scale recovery system, showing four I-R Type APH vertical turbine pumps.



Mill scale settling tank with pump pit in foreground.

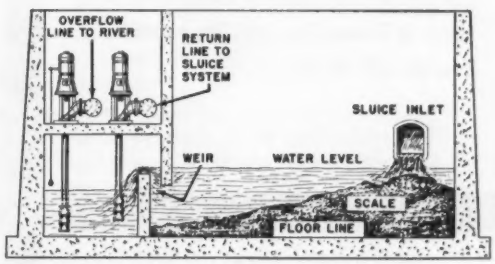
Here in Pittsburgh Steel Corporation's Allenport Plant, mill scale no longer pollutes the river. It is collected from the sluice system in a large settling tank—then scooped out and sintered to recover its valuable steel content for use in the blast furnaces.

Heart of the mill scale recovery system is the installation of I-R vertical turbine pumps shown above. Two large units recirculate settled water into the sluicing system at 6,000 gpm and 60 ft. head. The two smaller pumps, equipped with float control, discharge to another settling basin at 3,000 gpm and 40 ft. head, to prevent flooding of the pump pit.

These Ingersoll-Rand pumps handle mill water containing tough abrasive scale particles. But, through extensive research by I-R chemical and metallurgical departments and field engineers, materials with the necessary corrosion-erosion resistance were developed and built into these pumps.

Similar I-R vertical pumps are giving trouble-free service at many other steel mills in the area in a cooperative effort to reduce stream pollution.

Yes—There's no job too tough for an I-R pump!



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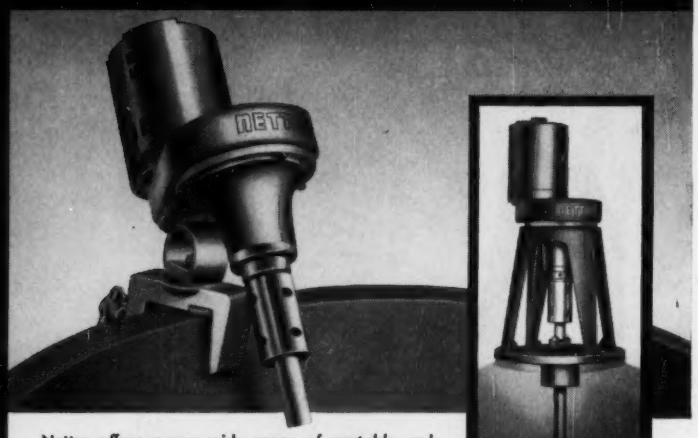
FIND OUT how Nettco standardized components can save you money — how this broad line of tank top, side entering, pipe line, and portable agitating equipment can be engineered economically and specifically to meet your own agitation requirements.

FIND OUT how the right agitator — the right shaft speed — the right horsepower — the right stirrer — will pay you big dividends in power economies and process time savings.

CHECK with Nettco Engineers for experience-proven answers to your agitation problems. New England Tank & Tower Co., 87 Tileston Street, Everett 49, Mass.



Nettco offers a new wide range of *portable* and *permanently mounted* mixers in capacities from ¼ to 2 HP, in high speed (1800 RPM) or medium speed (420 RPM) ranges. Features include: highest efficiency — leak-proof housing — adaptability to sanitary installations — motors in all standard speeds and open, totally enclosed, and explosion-proof construction. See the wide design flexibility of these versatile units at our Booth #52 at the Chemical Show.

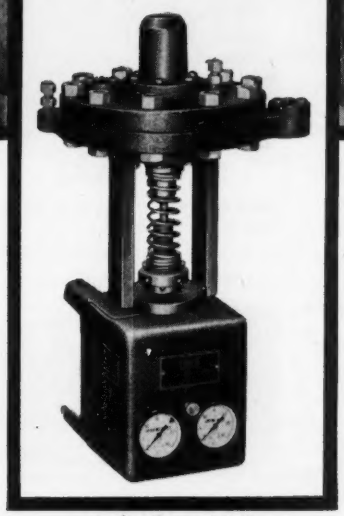
Here they are! New cast supports for Nettco Model WT and T Drives, for greater application flexibility and greater shaft stability on closed tank installations. See this new advance in agitator design at Booth #52.

See us at the Chem Show Booth No. 52.

NETTCO
ENGINEERED AGITATION

Here's the *pilot* with the *sense* to save *dollars*

Close Control



Leslie Type LA-2
Level Control Pilot

LESLIE FLOATLESS LEVEL CONTROL Pilots sense changes in liquid level that will help you maintain peak output. You save maintenance dollars, too — forget troublesome floats and cages (there aren't any).

With low resolution sensitivity (.1 of an inch change in level creates response), you are assured of smooth, throttling action and a closely held level.

You'll find Leslie Floatless Level Control Pilots in storage tank, boiler level and process vessel service — in fact, in any liquid level service where accuracy and dependability are important.

There are Leslie Pressure Control and Temperature Pilots with the sense to save dollars in pressure and temperature control stations, too. Your Leslie Engineer, listed under "Valves or Regulators" in your classified directory, will be glad to help you.

Send for Bulletin 5303 on Leslie Control Pilots

TRADE LESLIE MARK

REGULATORS AND CONTROLLERS

LESLIE CO., 279 GRANT AVENUE, LYNDHURST, NEW JERSEY

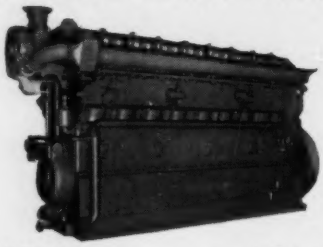
P 3573

CONTROLLED QUALITY MEANS QUALITY CONTROLS

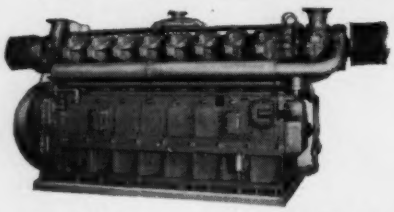
TOP PERFORMING Cooper-Bessemers

for every heavy-duty power and compressor need

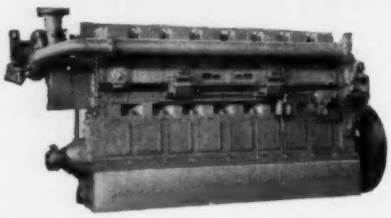
TYPE LSV .....12 or 16 cyl.
Atmospheric and Supercharged
Gas..... 1440 to 5000 hp.
Diesel and Gas-Diesel..1650 to 5000 hp.



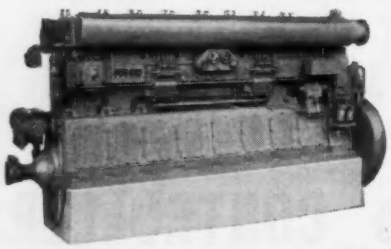
TYPE LS .....6, 7, 8 cyl.
Atmospheric and Supercharged
Gas ..... 660 to 2500 hp.
Diesel and Gas-Diesel.. 965 to 2500 hp.



TYPE FVA..... 6, 8, 12 or 16 cyl.
Diesel — Atmospheric .....310 to 835 hp.
Diesel — Supercharged ...560 to 2200 hp.



TYPE JS.....5, 6, 7 or 8 cyl.
Atmospheric and Supercharged
Gas .....325 to 1815 hp.
Diesel and Gas-Diesel....430 to 1815 hp.



TYPE GS..... 5, 6 or 8 cyl.
Atmospheric and Supercharged
Gas .....320 to 1460 hp.
Diesel and Gas Diesel....300 to 1460 hp.

● Available in a range of sizes from 100 to 5000 hp., Cooper-Bessemer engines and compressors are ready to meet *your exact requirements.*

The standard units shown here are typical of the many "top performers" now offered by Cooper-Bessemer. With "Tri Fuel" operation of most 4-cycle engines, and a new line of centrifugal compressors, Cooper-Bessemer continues to put into practice its policy of "Another Example of Efficient Power at Lower Cost".

Here, to list but a few, are plus values that make *every* Cooper-Bessemer a natural choice when it comes to purchasing new engines or compressors . . . low-cost operation, unmatched efficiency, extreme compactness, long-life dependability, easy accessibility, minimum maintenance and more than a century of engine building experience.

New bulletins offer the latest information. Get your copy by writing: The Cooper-Bessemer Corporation, Mt. Vernon, O.

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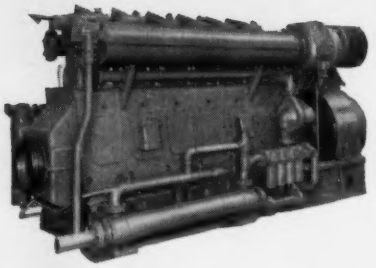
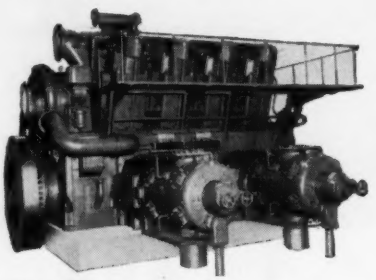
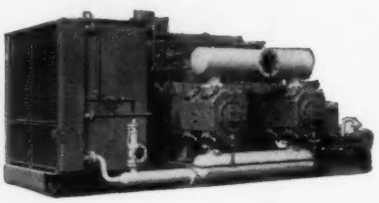


TYPE FWA .....6 cyl.
Diesel — Atmospheric ...245 to 500 hp.
Diesel — Supercharged .420 to 835 hp.

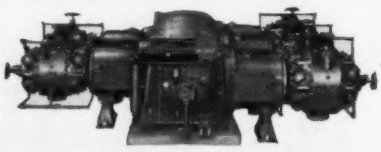
TYPE GMWA.....6, 8 or 10 cyl.
Gas Engine Driven Compressors
.....1500 to 2500 hp.



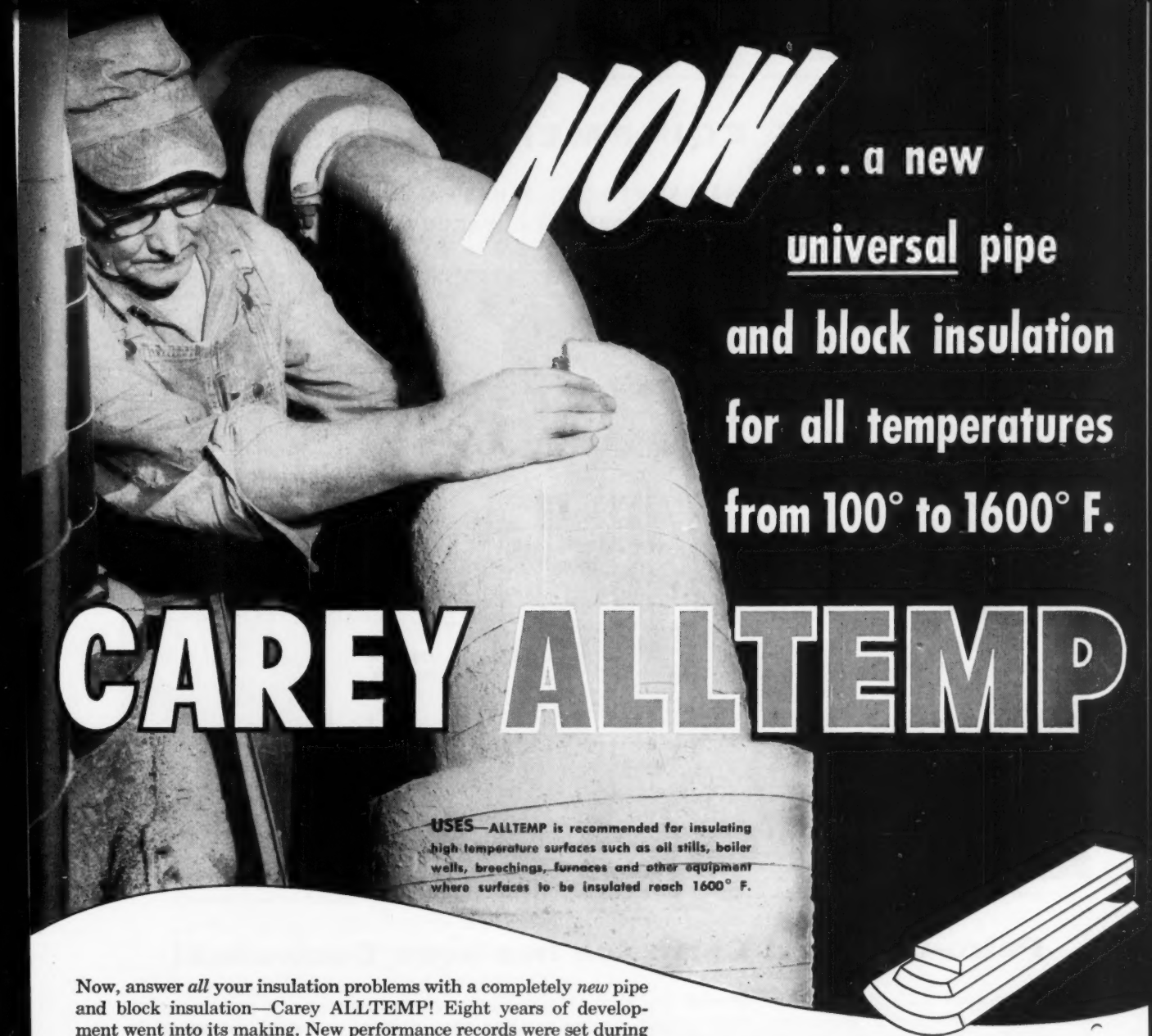
TYPE GMVA ..... 4, 6, 8, 10 cyl.
Gas Engine Driven Compressors
.....540 to 1350 hp.



TYPE GMXD .....4, 6, 8 or 10 cyl.
Packaged Unit
Gas Engine Driven Compressor . 265 to 660 hp.



M-LINE RECIPROCATING COMPRESSORS
100 to 5000 hp. 9″-14″ stroke
Speed to 514 RPM



NOW . . . a new universal pipe and block insulation for all temperatures from 100° to 1600° F.

CAREY ALLTEMP

USES—ALLTEMP is recommended for insulating high temperature surfaces such as oil stills, boiler walls, breechings, furnaces and other equipment where surfaces to be insulated reach 1600° F.

Now, answer *all* your insulation problems with a completely *new* pipe and block insulation—Carey ALLTEMP! Eight years of development went into its making. New performance records were set during exhaustive field and laboratory tests. Here it is—*a brand-new industrial insulation* for all temperatures up to 1600° F.

ALLTEMP keeps every last BTU on the job producing power. Its extremely low percentage of shrinkage—approximately ⅔ *less* than other 1200° F. insulation materials—means joints won't open, cracks won't appear in covering. BTU's are *locked in!* ALLTEMP retains its high thermal efficiency and structural strength even after long, continuous exposure to excessive heat and moisture. Non-brittle, it resists blows, abrasions; won't crack or crumble under severe service conditions. And it's easy on the hands—easy to cut, fit, install!

Get all the cost-saving facts on new ALLTEMP today and your copy of the Carey ALLTEMP specification folder.
Just address coupon below.

ALLTEMP RECOMMENDED THICKNESS

Nominal Pipe Size Inches	Temperature Difference °F 80° Air					
	200	400	600	800	1000	1200
	Nominal Thickness, Inches					
1½ & Under	1	1	1½	2	2½	3
2	1	1½	2	2½	2½	3
2½	1	1½	2	2½	3	3½
3	1	1½	2	3	3	3½
3½	1	1½	2	3	3½	3½
4	1	1½	2½	3	3½	4
4½	1½	2	2½	3	3½	4
5	1½	2	2½	3	3½	4
6	1½	2	2½	3½	4	4½
7	1½	2	2½	3½	4	4½
8	1½	2	3	3½	4	4½
9	1½	2	3	3½	4½	5
10	1½	2½	3	4	4½	5
11	1½	2½	3	4	4½	5
12	1½	2½	3	4	4½	5
14 & Over	1½	2½	3½	4	4½	5½

ALLTEMP is available in clean, easy-to-handle flat and preformed blocks. "Nesting" O.D. pipe covering sizes provide accurate, tight fits for multiple layer construction. Only a limited number of "prime" units are necessary for unusual assemblies.

Better Products for Industry Since 1873

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THE PHILIP CAREY MFG. COMPANY
Lockland, Cincinnati 15, Ohio
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Carey-approved contract units in major trading areas. Consult your nearest Carey District Office or your Telephone directory.

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Please send free illustrated folder showing specifications, installation details and complete facts on new ALLTEMP insulation.

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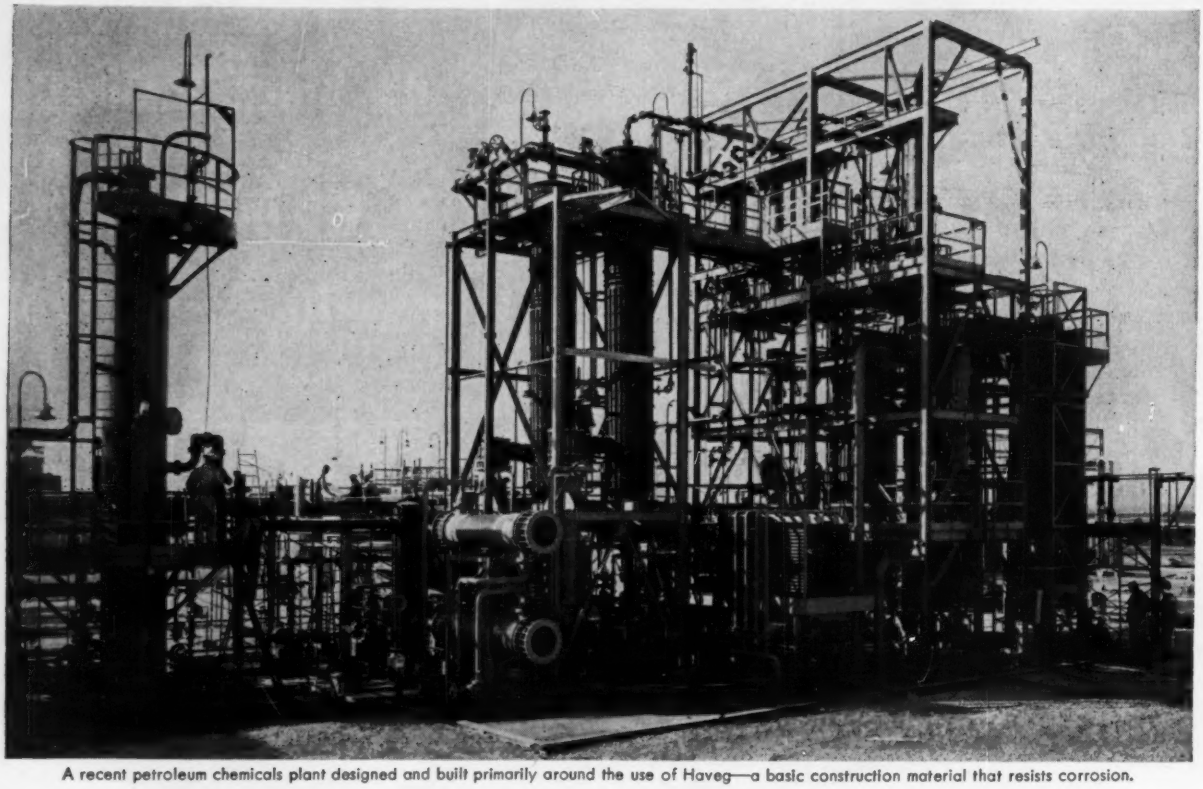
WHERE HAVEG EQUIPMENT IS INSTALLED

TRADE MARK REG. U. S. PAT. OFF.

PIPING • VALVES • FITTINGS • PRESSURE PROCESS TANKS • ABSORBERS AND SCRUBBERS
HEAT EXCHANGERS • FUME DUCT • PUMPS • VACUUM JETS AND CONDENSERS



A recent petroleum chemicals plant designed and built primarily around the use of Haveg—a basic construction material that resists corrosion.

Petro-Chemical Corrosion has been Controlled!

Now for designers and engineers of petro-chemical plants there is an old and proven basic material of construction, borrowed from its 22 years of service in the chemical and metallurgical industries. It is Haveg, a plastic molded in the form of finished process equipment, or available for many types of field fabrication. Made from acid-digested asbestos and special thermosetting resins, Haveg enables you to go into a high range of process temperatures with complete safety and a proven history of outstanding performance.

Haveg has three great virtues. It is completely resistant to most corrosion. It lasts for years. It is amazingly versatile.

Not a coating or lining, Haveg gives resistance to corrosion through its entire mass, never allowing corrosives an opening wedge from cracks. It resists thermal shock, seldom requires insulation.

From steel-jacketed pressure process tanks down to the last piece of pipe, many of the petro-chemical processes can be completely contained and kept free from corrosion. Unnecessary maintenance, controls, headaches are avoided. Should plans or processes change, Haveg equipment can be machined and altered by your men, on the job. Accidental mechanical damage is easily repaired, using Haveg cement. Full chemical resistance is maintained.

If your job is fighting corrosion, get a helping hand from Haveg. Call the experienced sales engineer listed. Write for the 64-page illustrated Bulletin F-6 which contains size and chemical resistance charts, design specifications. Remember, Haveg is a logical answer to your design problems in handling petro-chemicals; in fact, in all process equipment that must handle corrosives.

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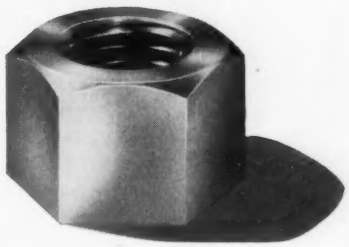
HAVEG CORPORATION

TRADE MARK REG. U. S. PAT. OFF.

900 GREENBANK RD., WILMINGTON 2, DEL., WYman 8-2276



SMALL BUT MIGHTY BIG!

It's just a simple hex nut—but it can easily prove vitally important to the successful completion or the efficient operation of a single unit or a complete processing plant.

That's just a good reason why careful attention to every detail of construction is highly significant to Procon. Constant alertness to the proper application of every component part—making sure that nothing is left to guesswork—results in better all-around construction.

Perhaps the best proof of such construction efficiency is most adequately evidenced by the number of companies that have selected Procon to handle a second, third and even a fourth construction project.

It's that kind of confidence that makes us realize even the smallest nut may prove a mighty big factor in our continued progress.

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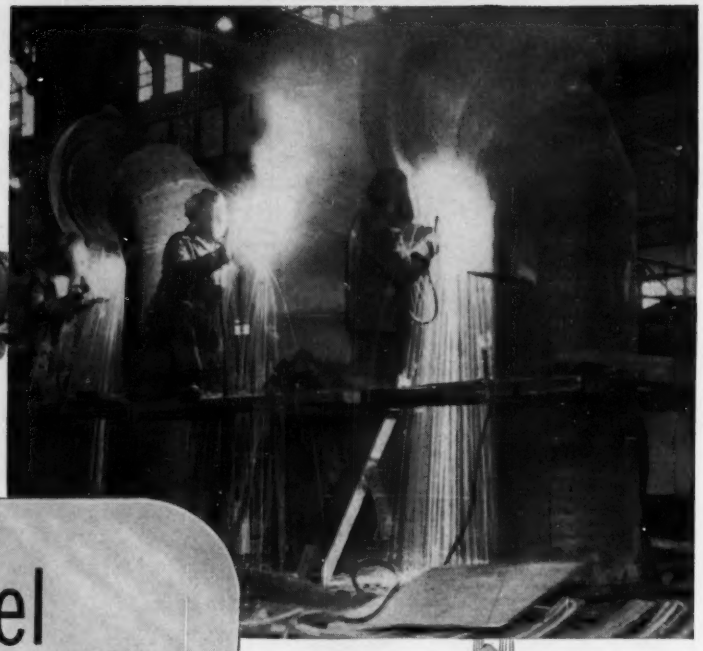
WORLD-WIDE CONSTRUCTION FOR THE PETROLEUM, PETROCHEMICAL, AND CHEMICAL INDUSTRIES



stainless steel holds the answers

Every industry that works with steel has its special problems of the proper steels for every job . . . more and more industries are finding that Stainless "holds the answers" to their problems.

Take the petroleum and chemical industries for instance. They demand resistance to corrosion, to abrasion, high temperatures, cold temperatures, scaling and hydrogen blistering. Solid stainless can do the job. But, in some equipment, stainless cladding can answer the problems . . . and cut costs as well.

Sun Ship knows how to fabricate stainless and the other special alloys. They have the facilities and experience. Large jobs or small jobs will receive prompt attention.

Our Sales Engineering Department will be glad to discuss with you any problems to which our Alloy Products Shop may hold the efficient and economical answer.

ALLOY PRODUCTS SHOP

OF Sun SHIPBUILDING & DRY DOCK COMPANY

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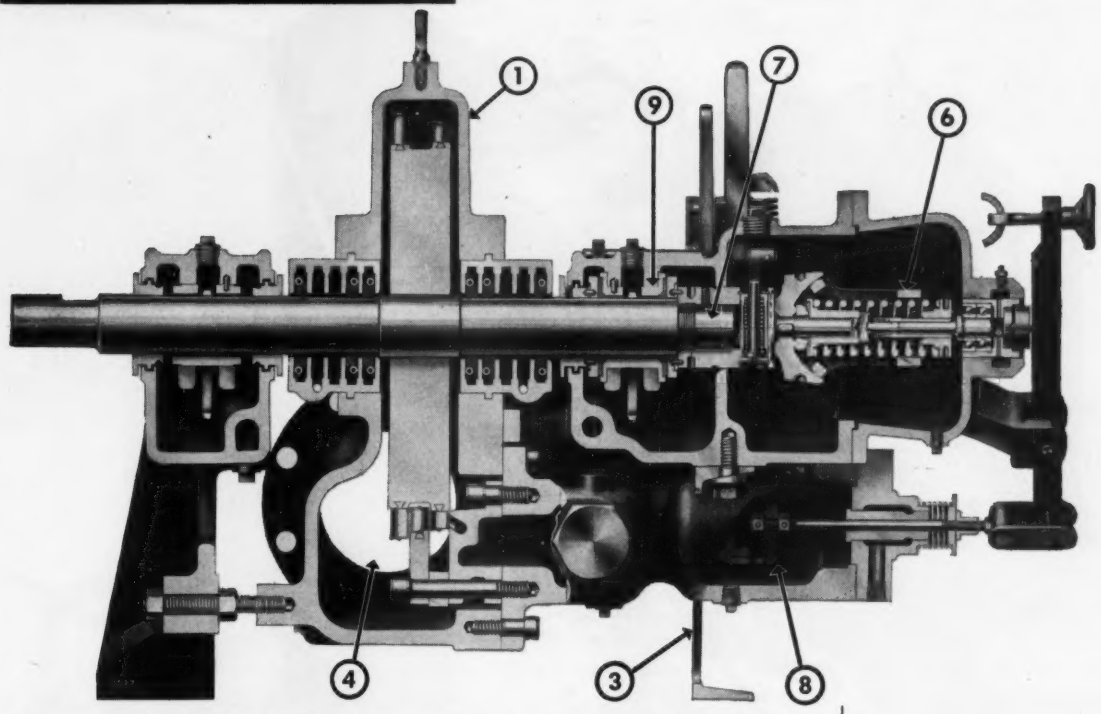
NEW DE LAVAL HCB SINGLE STAGE TURBINE

can be ordered from stock



1 Case and Cover Split Horizontally on centerline for ease of maintenance.

2 True Centerline Casing Support assures distortion-free radial expansion. *Not shown.*

3 Flexible Support at governor end provides for axial expansion.

4 Exhaust Opening either right or left side for installation flexibility.

5 Steam Strainer, protecting trip and governor valves, is *removable* for cleaning without breaking steam connections. *Not shown.*

6 Constant Speed Governor features governor weights pivoted around frictionless surfaces.

7 Complete Governor Assembly is now *replaceable as a unit.*

8 Balanced Single Seated Main Governor Valve has proportional flow characteristics for sensitive, positive control.

9 Shaft Locating Bearing of adjustable double collar type.

Horsepower: 100 MAX
Steam Pressure: 300 PSIG MAX
Steam Temperature: 550F MAX
Exhaust Pressure: 25 PSIG MAX
Speed: 4,000 RPM MAX
Steam Inlet: 2"–250# ASA FLG.
Exhaust: 6"–150# ASA FLG.
Weight: 1,200 LB

Here's the new De Laval HCB Single Stage Turbine which is now "on the shelf" . . . ready for immediate shipment. This mechanical drive turbine is simple, rugged, designed for long economical life and low maintenance. For example, note the true centerline casing support, the replaceable governor, the removable steam strainer. Investigate all the advantages of this versatile driver. It is ready to handle—*at low cost*—a variety of applications in your plant.

Send for new Bulletin 4206
which gives vital facts and figures

DE LAVAL *Mechanical Drive Turbines*

DE LAVAL STEAM TURBINE COMPANY
803 Nottingham Way, Trenton 2, New Jersey

DL208

DAVISON CHEMICAL CORPORATION

dries petroleum catalyst with a STANDARD HERSEY ROTARY DRYER

Intermediate Feed System makes Combination Dryer

The patented STANDARD-HERSEY intermediate-feed system makes the dryer used by Davison Chemical Corporation a combination flash and rotary dryer. This combination retains the most desirable characteristics of each.

Here is another example of the engineering skill developed by the 52 year old Standard Steel Corporation. Thousands of successful dryer applications such as this give STANDARD-HERSEY an unsurpassed background to draw on in solving your drying problems. More than 30 different dryer types are available to fit any drying requirement. Contact STANDARD-HERSEY for the most profitable, most productive solution to your drying needs.

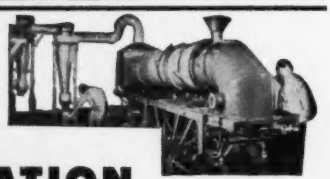
DF-4

SEND FOR FREE 12-PAGE ILLUSTRATED BULLETIN

Learn how STANDARD-HERSEY has aided manufacturers throughout the world in solving their dryer problems.

COMPLETE PILOT PLANT TAKES GUESSWORK OUT OF DRYING

STANDARD-HERSEY'S pilot dryers play an important part in solving your drying problems *before* blueprint stage.



THE STANDARD FOR 52 YEARS

STANDARD STEEL CORPORATION

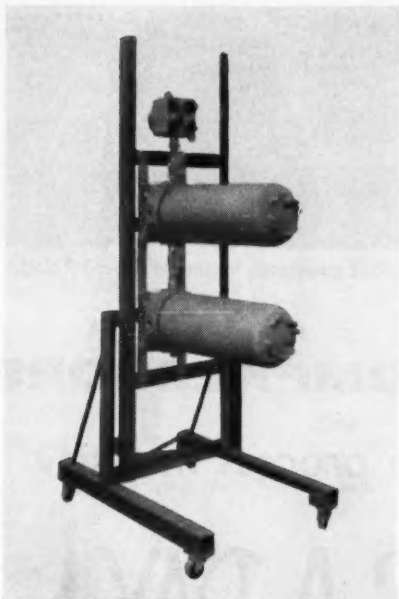
5005 BOYLE AVENUE, LOS ANGELES 58, CALIFORNIA • 15 PARK ROW, NEW YORK 5, NEW YORK

Analysis moves from Lab to Line with P-E Infrared Analyzers

It's getting to be old-fashioned to run a stream composition determination in the control laboratory. Chemical manufacturers can now hook analytical instruments directly into the process stream where they produce continuous and instantaneous data to guide the operation of the system.

Perkin-Elmer has designed a variety of infrared analyzers for this purpose: the TRI-NON* group of nondispersion analyzers, series A, B, C and D; and the BICHROMATOR* Analyzer operating on the dispersion principle. Each is designed to solve a particular class of continuous analytical problem and performs a continuous analysis of a single component in a liquid or gas stream. Within each series, variation of standard components permits tailoring to specific problems.

P-E application engineers can provide all the help you need in the selection of the proper equipment for any given analysis. Service facilities are nationwide.

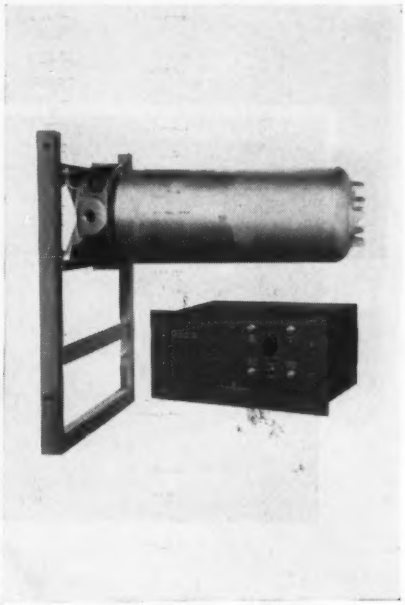


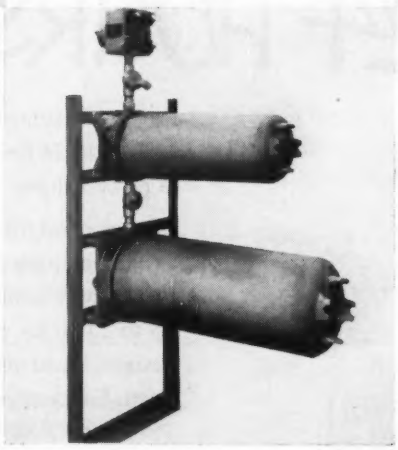
TRI-NON SERIES A

This is the deluxe series, offering maximum performance in all respects. These instruments are high in sensitivity, stability and discrimination, will operate under extreme ambient conditions, and are completely explosion proof. The pick-up section produces a shaft rotation which is proportional to the concentration of the gas of interest. This shaft rotation may appear, if desired, as an indicator at the instrument. Normally, it is transmitted through a slide wire potentiometer bridge circuit to the recorder by a 3 wire cable. This transmission system is not limited by a low voltage level and thus, there are no restrictions on the separation between the recorder and the analyzer.

TRI-NON SERIES B

Explosionproof pick-up section with remotely located nonexplosionproof electronics and recorder. A multiwire cable over a maximum of approximately 500 ft. connects the two units. Performance, in the main, is equivalent to Series A instrument. Moderate price range. Usually this model involves a single servo loop incorporating the recorder.





TRI-NON SERIES C

Nonexplosionproofed. Pick-up section is nonexplosionproofed and connected by multiwire cable over a maximum of 500 ft. to the electronics section which is also nonexplosionproofed. Here again, this model involves a single servo loop incorporating the recorder. Somewhat less selective than other series but highly stable and adequate for many process stream analyses.

TRI-NON SERIES D

Nonexplosionproofed. All components — pick-up section, electronics and recorder — mounted in a cabinet with the pick-up section mechanically coupled to the recorder; has the same performance characteristics as Series C.

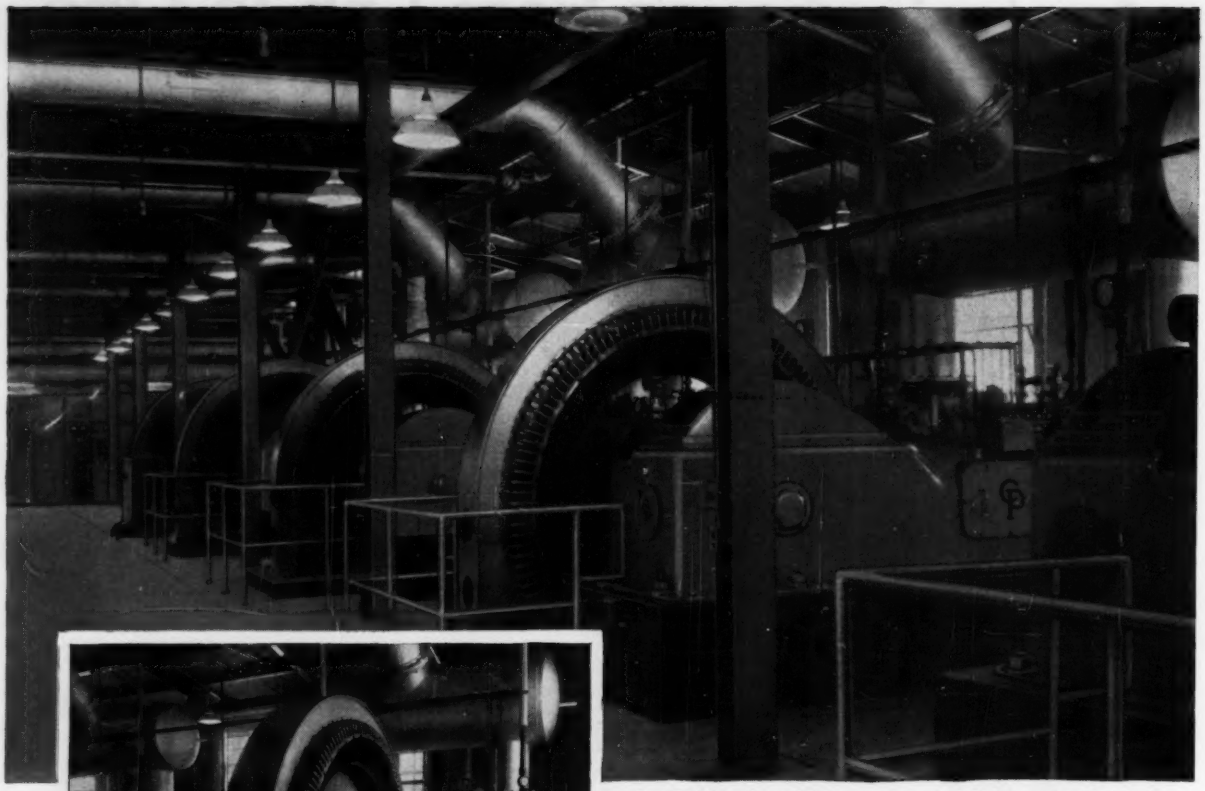
BICHROMATOR ANALYZER

Available explosionproofed and thermostatted. Automatic circuit testing and unitized construction simplify field servicing. Duplicates in a plant-designed instrument, the base line density method widely used in the infrared control laboratory.

THE **Perkin-Elmer** CORPORATION

830 Main Avenue, Norwalk, Connecticut

*TM The Perkin-Elmer Corporation



Five 1,000 hp Class O-DE compressors installed in a chemical plant.

CP COMPRESSORS

in the process industry

ON TAP 24 HOURS A DAY!

Chicago Pneumatic's heavy duty, Class O Compressors answer the 24 hour-a-day service demands usually required in process industries.

Engineered for continuous, heavy-duty usage, the Class O affords complete dependability with low operating cost. And they require minimum attention and upkeep. Built in sizes up to 2,000 hp, they're available in single and multi-stage designs, steam and electric drives, for a wide range of pressures. For more information write for Bulletin 726. *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, New York.*

Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

☒ Check list for LITHIUM Researchers—No. 1

Lithium has enabled industry after industry to achieve over-all savings through shortcuts, reduction of waste, improvement of end-product, and simplification of operating procedures. Check your field of interest in Lithium below. If you are interested in a specific application relative to Lithium not indicated in the checklist, note the fact in the form furnished, attach it to your letterhead and send it to us. Our research laboratory will look into the matter for you.

LITHIUM METAL AND METAL DERIVATIVES

LITHIUM INGOT

Uses:

- ☐ Alloys
- ☐ Degasification of alloys (copper and aluminum)
- ☐ Organic chemicals
- ☐ Organic reduction

LITHIUM RIBBON WIRE AND SHOT

Uses:

- ☐ Preparation of new drugs
- ☐ Organic chemicals

LITHIUM CARTRIDGES

Uses:

- ☐ Refinement of alloys (copper and aluminum)
- ☐ Aluminum castings
- ☐ Brass, bronze and nickel-silver castings

LITHIUM AMIDE

Uses:

- ☐ Preparation of Organic chemicals

LITHIUM HYDRIDE

Uses:

- ☐ Organic chemicals
- ☐ Pharmaceuticals
- ☐ Generation of hydrogen
- ☐ Reducing agent
- ☐ Drying agent

I am interested in Lithium_____ for
(Compound, Metal or Derivative)

the following application:_____

_____

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Technical Data Sheets are available for every compound in the checklist. They will be sent as checked above.

. . . trends ahead in industrial applications for Lithium

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MINES: Keystone, Custer, Hill City, South Dakota • Bessemer City, North Carolina • Cat Lake, Manitoba • Amos Area, Quebec • BRANCH SALES OFFICES: New York Pittsburgh • Chicago • CHEMICAL PLANTS: St. Louis Park, Minnesota • Bessemer City, North Carolina • RESEARCH LABORATORY: St. Louis Park, Minnesota

Fabric helps Alcoa turn "Red Mud" into magic metal—

Aluminum at its versatile best—the Alcoa building in Pittsburgh.

Increasingly efficient production methods are a prime factor in the constant growth of the aluminum industry. In this efficiency, a new Wellington Sears fabric is playing a vital role. In the process of refining aluminum from bauxite at Alcoa's Bauxite, Ark. plant (shown at left), an insoluble "red mud"—iron, silicon, and titanium—is filtered out. Some aluminum, however, still remains in the "red mud" residue. But today Alcoa's modern methods of refining this one-time waste have remarkably increased aluminum output.

The process places heavy stress on the filtering fabric. The problem of developing a filter cloth that would stand up to strong caustics and provide easier "cake" discharge was given priority at Wellington Sears. We are proud that our specially developed fabric has been approved by Alcoa for commercial use.

In this way, for over a century, Wellington Sears has tried to blueprint fabrics for industrial progress. Whatever your filtration problem—why not talk to one of the leading filtration experts who distribute our fabrics. Most likely there's a Wellington Sears cotton or synthetic fabric that will help solve it.

Write us for illustrated booklet on "Filter Fabric Facts." Address Dept. L11

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WHEN SEVERE CORROSION IS YOUR PROBLEM . . .

use Carpenter Stainless No. 20 and No. 20Cb

TO S-T-R-E-T-C-H EQUIPMENT LIFE . . . CUT COSTS

The super corrosion resistance of Carpenter Stainless No. 20 and No. 20Cb to strong acids, pickling solutions, gases, and other severe corrosives is enabling a fast-growing number of processing plants and equipment manufacturers to greatly increase equipment life, reduce down-time for replacements, and lower corrosion control costs.

For instance, the unique dust handling unit, over 8 ft. high, shown above was made *entirely* of Carpenter Stainless No. 20 and No. 20Cb for a chemical company to provide long-life corrosion and abrasion resistance to dust and vapor containing sulphuric, nitric and hydrofluoric acids, and sodium aluminum sulphate.

These time-saving, cost-cutting super stainless alloys provide extraordinary resistance to sulphuric acid and are completely unaffected by a long list of other strong corrodents. They are available in the form of tubing, pipe, sheet, plate, bars, billets and wire.

For data on corrosion resistance, properties, performance results, uses, and fabrication of Carpenter Stainless No. 20 and No. 20Cb, ask for Bulletin 108A.

If you design, build, or use equipment that must withstand strong corrosive attacks, why take chances on getting satisfactory results with ordinary corrosion-resistant materials? Find out how Carpenter Stainless No. 20 and No. 20Cb can save you time, trouble and money . . . have your nearest Carpenter Distributor or Representative give you the full story.

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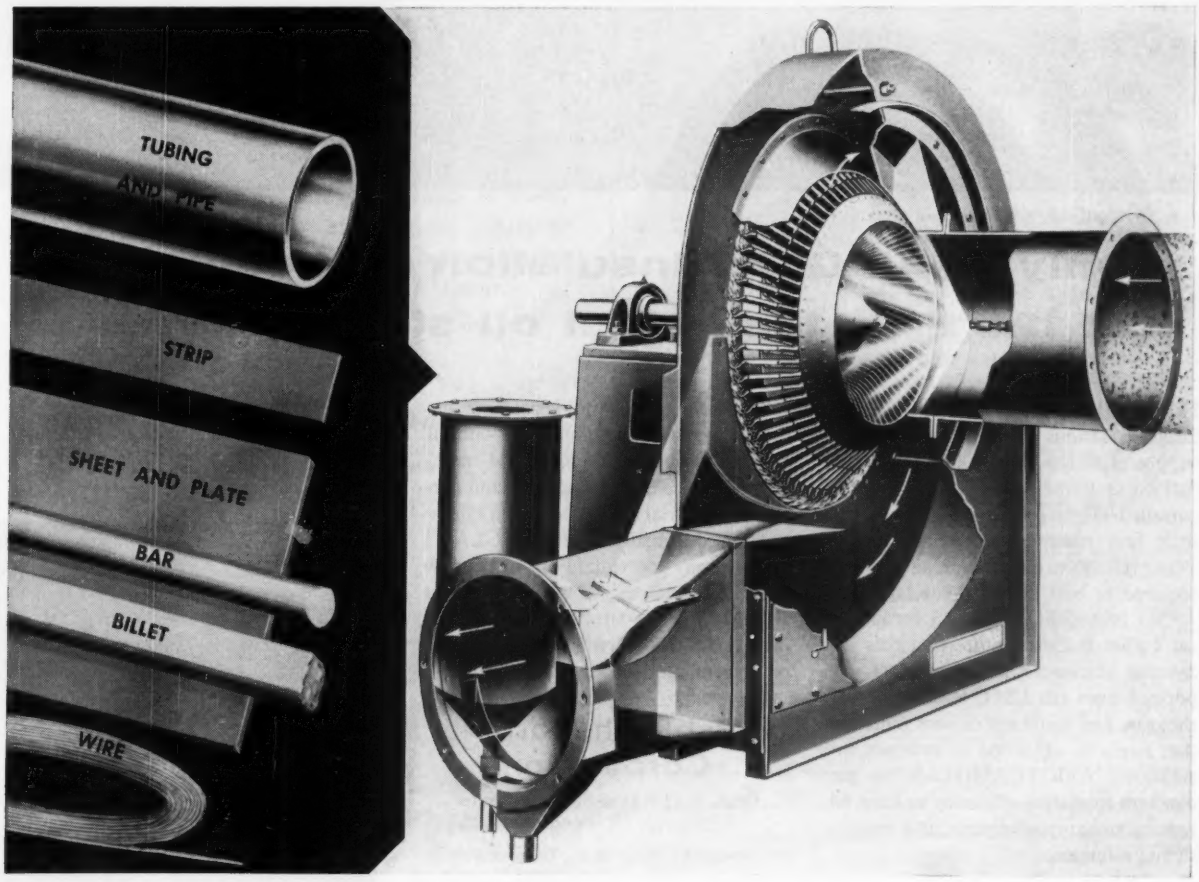
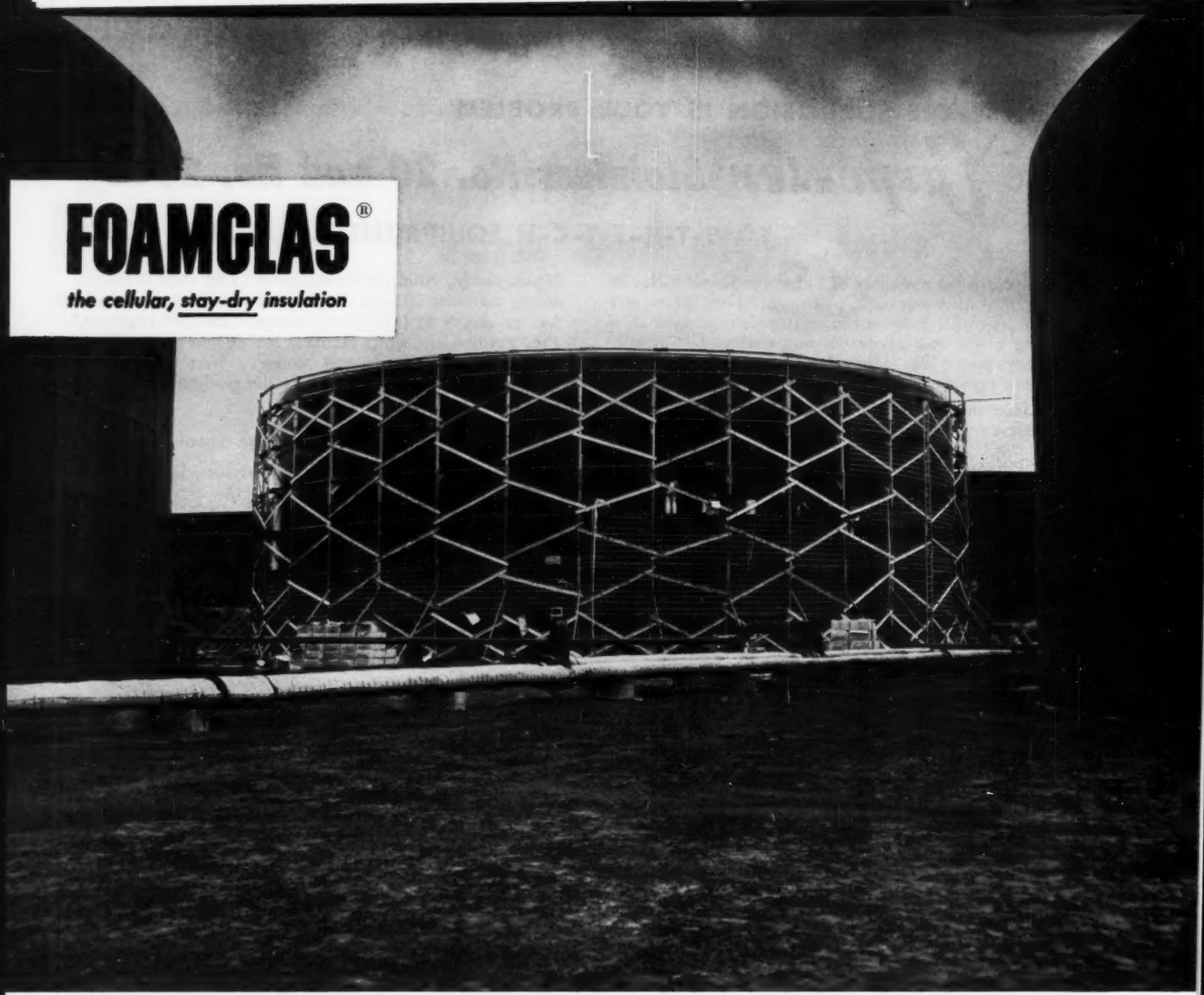
more than corrosion resistance

Stainless Tubing & Pipe

Carpenter No. 20 bars, strip, wire and billets are available also from The Carpenter Steel Company, Reading, Pa.





FOAMGLAS®
the cellular, stay-dry insulation

Only FOAMGLAS insulation can stay dry at 120°F on these fuel oil storage tanks

FUEL OIL CORPORATION officials faced a serious problem when their supply of steam needed to heat heavy fuel oil at River Rouge, Michigan was curtailed. They solved it by insulating their four massive storage tanks with FOAMGLAS to cut the volume of steam required to heat the oil. They say:

"We picked FOAMGLAS because it can't absorb the moisture that cuts insulating efficiency. This was most important since the 120°F temperature of the stored oil could not dry out moisture that might be absorbed by ordinary insulations. With FOAMGLAS, we get constant insulating efficiency to keep oil heating steam requirements at a money-saving minimum.

"We save money, too, because we get this lasting insulating protection without high insulation replacement and maintenance costs. Even oil spillage and corrosive industrial atmospheres can't damage fireproof, acid-proof FOAMGLAS."

It will pay you to find out today how you, too, can save money by using FOAMGLAS. Write for our booklets on insulation for piping, tanks and other equipment.

Pittsburgh Corning Corporation

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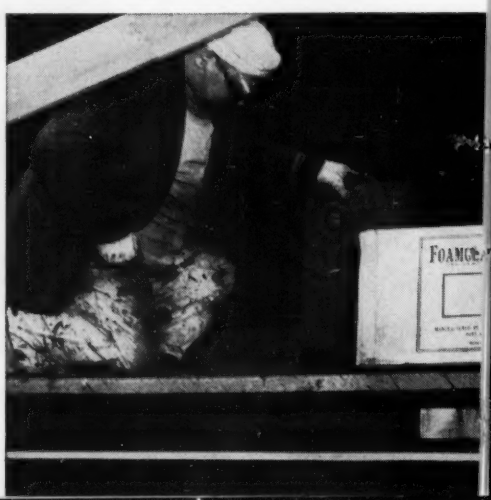
Flat 2" blocks of FOAMGLAS are applied to surface of 117' dia., 41' high tank. Blocks were banded in place then sprayed with coat of asphalt cutback. Insulation Contractor was G. H. Gotshall Co., Detroit, Michigan.



PRESENTING THE
ALL-NEW

Dings DYNAMIC

PERMA-PLATE MAGNETS
FOR EFFICIENT—LOW COST TRAMP IRON REMOVAL

DINGS—The world's largest exclusive builder of magnetic separation equipment—now brings to all industry an entirely new concept of efficient, low cost tramp iron removal . . . through the completely new line of non-electric Alnico Perma-Plate Magnets, incorporating the *DYNAMIC* principle of magnetic separation.

Designed and built to remove tramp iron from moving material carried in chutes, ducts, on conveyor belts and slides, these new powerful, guaranteed permanent Alnico V magnets are used to separate iron from grain, feed, chemicals, foodstuffs, plastics, fertilizers, minerals, textile fibers, liquids and wet and dry solids of many kinds. Perma-Plates are also needed wherever tramp iron or iron of abrasion can damage processing equipment, create fire hazards, or contaminate product purity.

Clip the coupon for full details.

The new Dings DYNAMIC Perma-Plates are plate type permanent non-electric Alnico magnets designed to attract moving iron. This proven design is the result of hundreds of extensive *dynamic* tests . . . *not* based on static tests.

As shown by illustrations (1) and (2), a *pull test* is a static test having negligible bearing on the magnet's ability to attract rapidly moving iron. It is not *dynamic.*

Illustration (3) shows a *lift test,* again a static test having negligible bearing on the magnet's ability to attract moving iron. It is not *dynamic.*

Illustration (4) shows a *chute test* . . . the only *true* test of a plate magnet's ability to attract rapidly moving iron. *This is the DYNAMIC principle of operation of the new Dings Perma-Plate Magnets.*

DINGS MAGNETIC SEPARATOR CO.
4730 WEST ELECTRIC AVENUE
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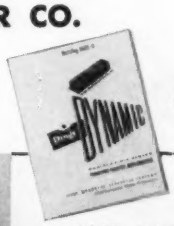

The new Dings Perma-Plates are available in 4 basic types, offering effective magnetic ranges from 2½" through 4". Each type is available in 35 standard sizes from 4" through 72" wide.

Complete details of these versatile DYNAMIC Magnets are given in the new Catalog 1205-D, just off the press. Mail coupon for your copy.

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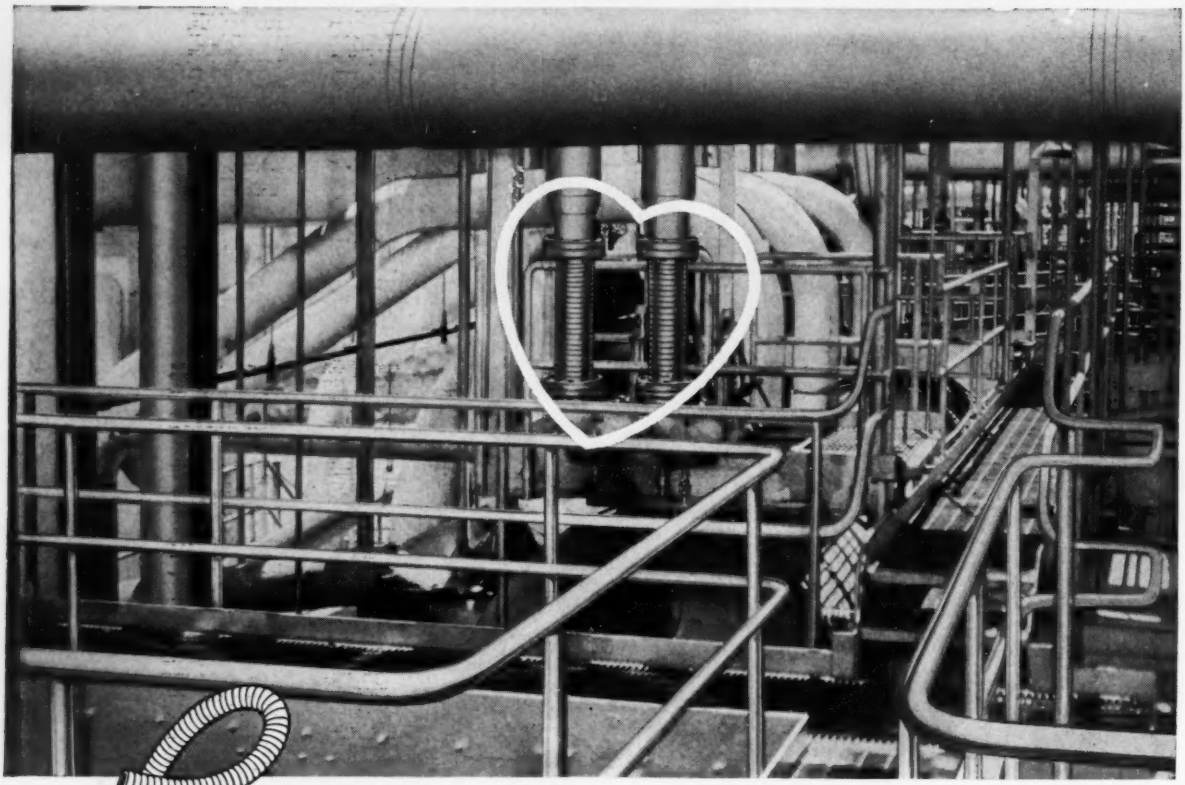

Penflex CUSHIONS THE BLOW IN BLOW-OFFS

Flexible tubing absorbs shocks from sudden release of superheater steam

Shock . . . temperature . . . pressure . . . all suddenly combine to liberate steam at 900°F. and 850 psi. Pushing out in every direction as blow-off valves release a flood of energy . . . the expansion joints get the full impact, and the full responsibility of keeping the steam headed toward the stack.

It's not the job for a weak-kneed joint, and operators of this utility plant knew it. They played it safe and put lengths of Penflex Galvanized Steel Interlocked Tubing (8" I. D.), flanged at both ends, as expansion joints on forty-two units throughout the entire plant.

The joints are dependable because the tubing is strong . . . tight . . . and flexible enough to "give" with the shock of sudden pressure and thermal expansion.

This, and hundreds of other applications in the steam and Diesel power fields, are filled by Penflex tubing. Proper selection and application of flexible tubing is a study in itself—one which we call "Flexineering." Call our engineer to show you how it is applied to your problems, or write for our "Flexineering" booklet. There's no charge or obligation.

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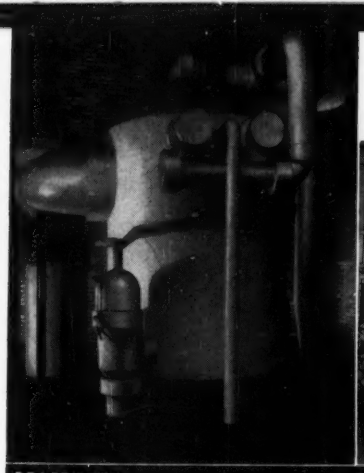
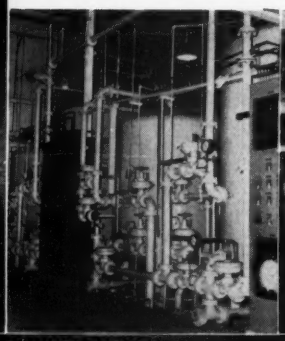
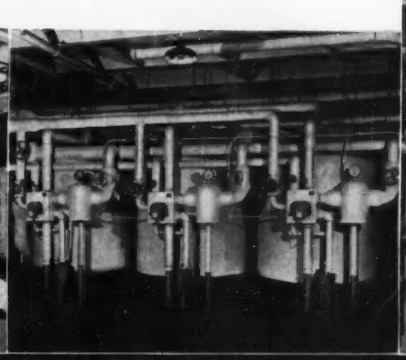
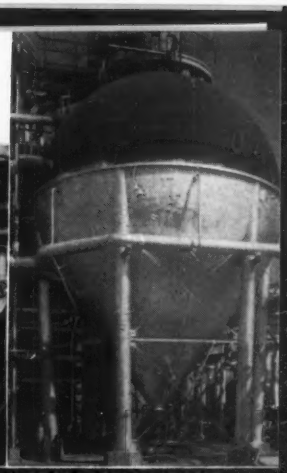
See the Cochrane Booth No. S111 at the Chemical Show Dec. 5-9


DEAERATOR


DEMINERALIZER


ZEOLITE SOFTENER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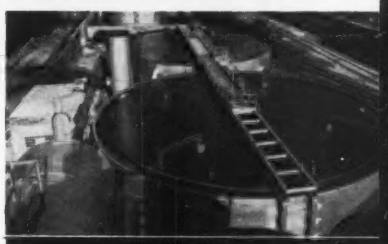
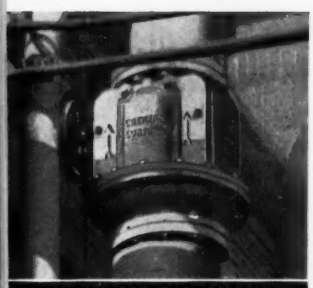
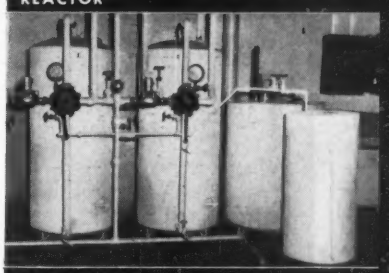
Development of the Cochrane Hydromatic Valve sets a new standard in automatic control for Ion Exchange Processes.

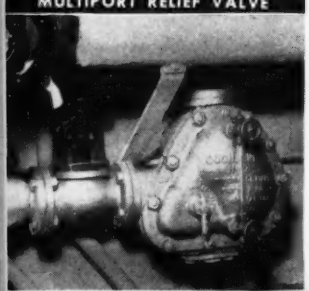
Cochrane's background as heat engineers has also been responsible for the development of steam specialties recognized and used throughout industry today. The C-B Jet Pump improves heat transfer, reduces drying costs with resultant product improvement and usually increases production output.

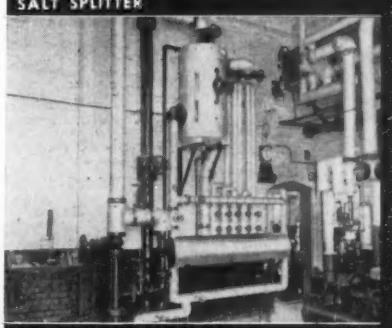
This complete service, available at Cochrane, provides a single responsibility for continuous satisfactory operation of every installation. It is an assurance that guarantees will be met. Why not consult Cochrane?

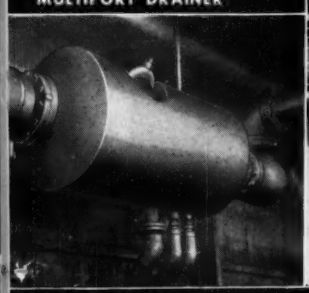

REACTOR

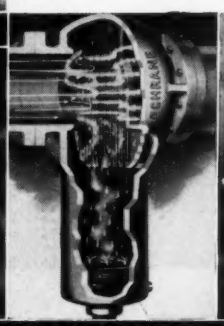

MULTIPORT RELIEF VALVE

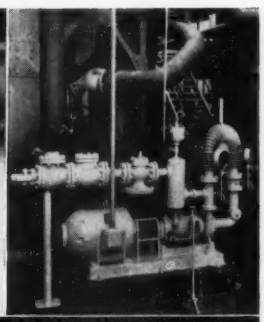

SALT SPLITTER

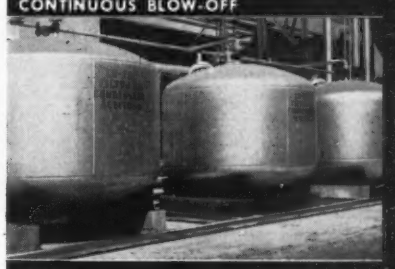

MULTIPORT DRAINER


CONTINUOUS BLOW-OFF


STEAM PURIFIER


OIL SEPARATOR


C-B SYSTEM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Cochrane
CORPORATION

Representatives in 30 principal cities in U.S.; Toronto, Canada; Paris, France; La Spezia, Italy; Mexico City, Mexico; Havana, Cuba; Caracas, Venezuela; San Juan, Puerto Rico; Honolulu, Hawaii.
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PROTECTIVE COATINGS
. . . the tough skin of industry

We can show you INSUL-MASTIC Coatings that have been preventing corrosion for 10, 12 and 15 years. Many of these applications are in industrial plants where corrosive fumes and vapors have been known to eat through other coatings within a very short time.

These INSUL-MASTIC Coatings have lasted through these many years without need of replacement.

This is an exceptional record. It should be considered seriously when you specify Protective Coatings.

It pays to think *first* of the coatings that *last* . . . INSUL-MASTIC.

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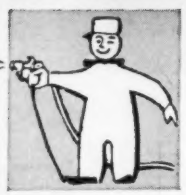

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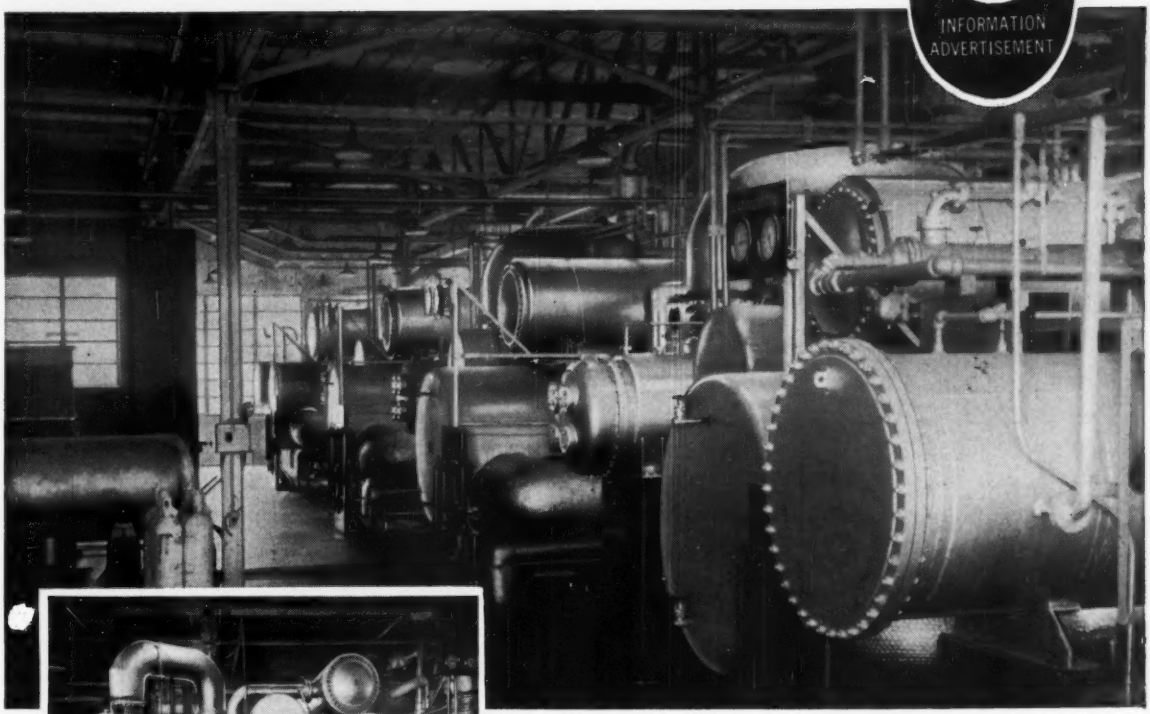
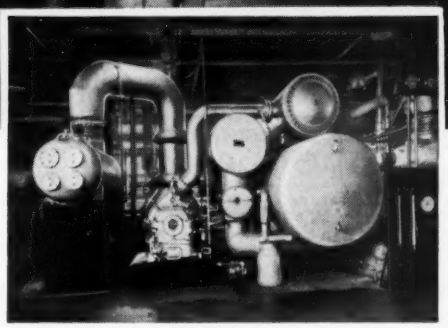
NEW facts for your files on York Turbo Compressors for

Chemical Plants

INFORMATION ADVERTISEMENT





Four York Turbo Compressors operating on four York Turbo Brine Chilling Systems help keep production and quality at high levels for the Firestone Tire & Rubber Co., Lake Charles, Louisiana. One of these York Turbo Brine Chilling Systems is shown in greater detail in the inset at left. Each York System is capable of producing in excess of 400 TR at a leaving brine temperature of +5° F. The units are also designed to produce 230 TR at a leaving brine temperature of −35° F. Firestone uses these York Systems in the manufacture of cold GR-S rubber. The cold brine is circulated through York-designed coils in each reactor to produce the desired cooling effect.

MORE LOW-TEMPERATURE PROCESSES TODAY—and whether you need dependable, constant-capacity refrigeration on a 24-hour, seven-day-week basis, or have an application where refrigeration loads will fluctuate, York Turbo Compressors will do the job.

LOW-TEMPERATURE PROCESSES HAVE TRENDED LOWER—and York Turbo Compressors provide efficient operation in low-temperature processes down to −125° F. (using "Freon-12").

FLOOR SPACE AT A PREMIUM—and a single York Turbo Compressor may fill all your refrigeration needs. York makes Turbo Compressors, in single- and multiple-stage models, up to 3000 tons capacity with Freon refrigerants. (Models also available for ammonia and hydrocarbon refrigeration duty and for general gas compression service.)

CHOOSE YOUR POWER SUPPLY—York Turbo Compressors may be driven by A.C. or D.C. electric motors, either constant or variable speed, steam turbines or internal combustion engines. You choose the power supply that is most economical for you.

EXTREME FLEXIBILITY—even where constant-speed drive is used, York Turbo Compressors, with their exclusive Pre-Rotation Vanes, permit efficient operation over wide ranges of capacity, using either automatic or manual control.

ENGINEERING ASSISTANCE—York's vast experience in the centrifugal compression field is part of a complete York service available to your designer.

Some Helpful Hints for Chemical Men

1. A temporary replacement for broken peepholes in chemical plant equipment can be made by cutting out the bottom of a Pyrex-type saucepan of blue boro-silicate glass. It can be made to fit perfectly by wet stone grinding.

2. To seal pipes against vacuum or low pressure without shutdown, wrap a split piece of polyethylene tubing around joint, melt with blowtorch to produce seal.

3. Install skid-proof metal plates around reaction kettle manholes to avoid damage to thermal insulation when workers must open the manholes.

CUT ALONG THIS LINE AND FILE

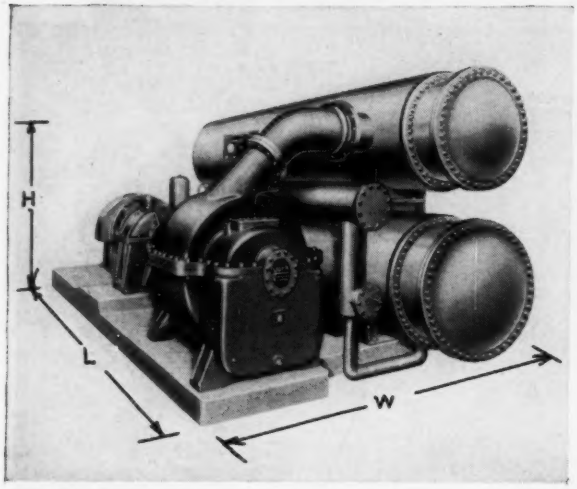
A.I.A. FILE NO. 30-F-22

CUT OUT AND FILE—SEND FOR FREE FILE FOLDER AND REPRINTS—SEE OTHER SIDE

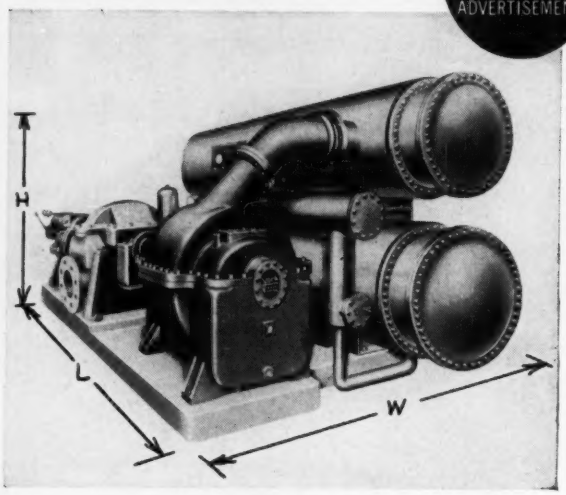
YORK TURBO COMPRESSORS FOR CHEMICAL PLANTS (cont.)

YORK TURBO COMPRESSORS

INFORMATION ADVERTISEMENT



MOTOR DRIVE



STEAM TURBINE DRIVE

York Freon Turbo Compressor Systems are particularly adapted to high-capacity refrigeration loads. Their inherent ability to handle large gas volumes permits maximum capacity per unit of floor area, while their vibration-free design permits installation in any convenient location—even on upper floors. These characteristics insure a highly compact and economical installation.

DIMENSIONS

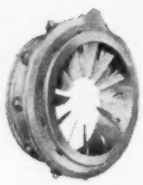
(Depending on model chosen)

Type	"L"	"W"	"H"
Motor Drive	14′6″ to 20′9″	9′9″ to 15′10″	6′8″ to 12′8″
Steam Turbine Drive	14′6″ to 16′0″	9′9″ to 15′10″	6′8″ to 12′8″

NOTE: Dimension "L" will vary with type and size of motor and gear, or with type of turbine. All dimensions are based on 2- and 4-pass shells. Purge device adds 21″ to overall "W" dimension.

PRINCIPAL (AND EXCLUSIVE) FEATURES

IMPELLER. Blades, hub and cover discs are made *entirely* of stainless steel—impeller blades successfully resist erosion . . . the entire wheel resists corrosion—assuring perfect wheel balance during service life. Blades are end milled to form integral rivets, eliminating heads and resulting in unobstructed gas flow and noise abatement.



PRE-ROTATION VANES for maximum capacity reduction. Capacity control is accomplished by changing direction of the rotation of suction gas entering the first stage wheel, thereby changing the characteristics of the wheel. Each change produces the same results as a separate machine of smaller size.

SIMPLIFIED REFRIGERANT SHAFT SEAL prevents gas leakage. Sealing is accomplished by two stationary carbon rings kept always in contact with the shaft seal ring. Seal surfaces are accurately finished and sealed with oil from the compressor lubricating system.

THRUST ABSORBING BALANCE DISC CUTS FRICTION LOSSES. Unbalanced shaft thrust caused by unequal gas pressure on opposite faces of each wheel equalized by balance disc. Need for a heavy duty thrust bearing with attendant higher friction losses eliminated.

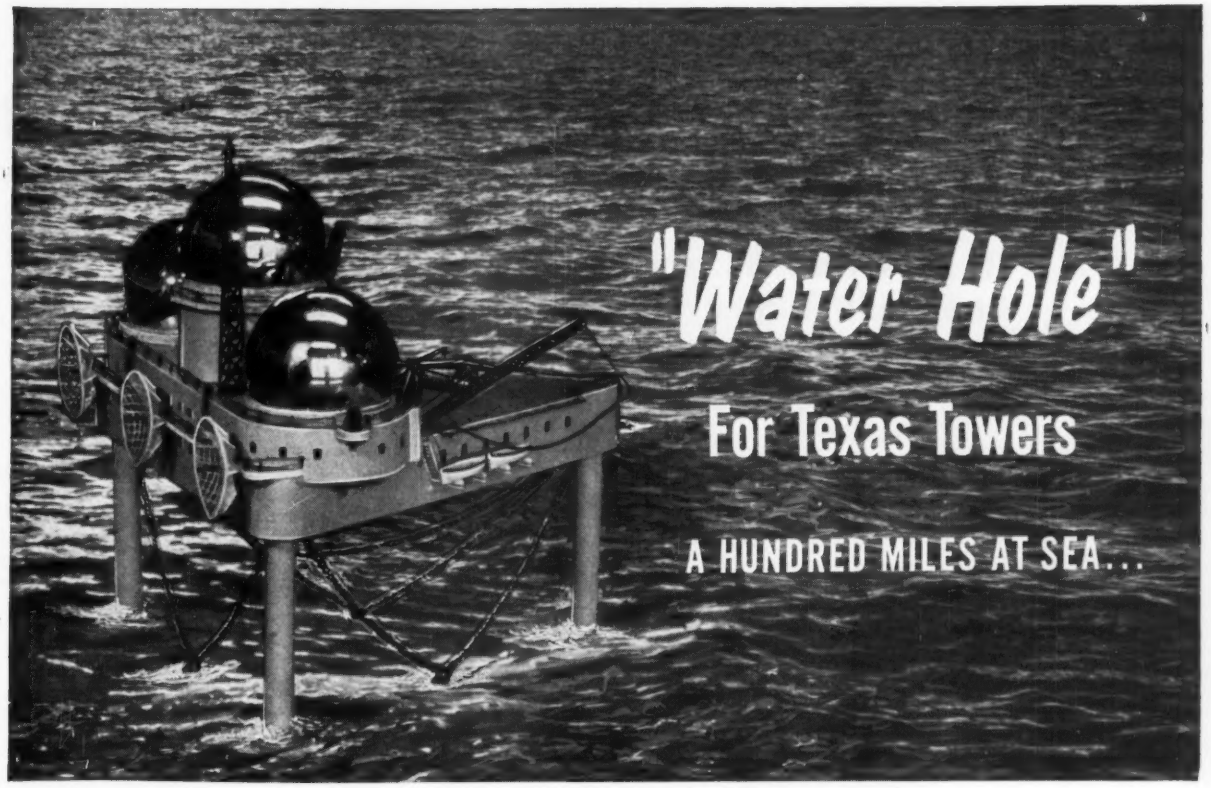
York Corporation, York, Pa.

YORK CORPORATION

the quality name in refrigeration

HEADQUARTERS FOR MECHANICAL COOLING SINCE 1885

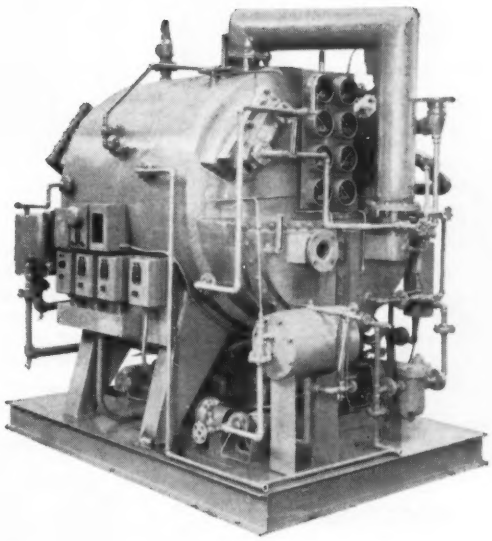
CUT ALONG THIS LINE AND FILE



Early-warning radar stations, standing far out in the open ocean, need plenty of fresh water—for drinking as well as other purposes. And to supply it, they depend largely upon sea water evaporators using Bridgeport condenser tubes.

In these installations Bridgeport 90-10 Cupro Nickel Tube was chosen because of its excellent service in evaporators handling sea water. Its resistance to general impingement corrosion at high velocities often offers unique advantages over other alloys in many applications.

This is but one of many effective applications of a particular Bridgeport Condenser Tube Alloy —carefully selected to give optimum performance on a specific job. Bridgeport's Technical Service will be glad to help you select from a wide range of Bridgeport alloys the one tube best suited to your particular operating conditions. Call your nearest Bridgeport Sales Office for complete information.



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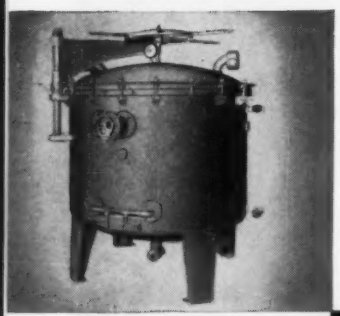

VERTICAL FILTERS

With Industrial's exclusive self-cleaning air wash. Extra large cake space. Built for corrosive, viscous or hot fluids. Simplified lockup.

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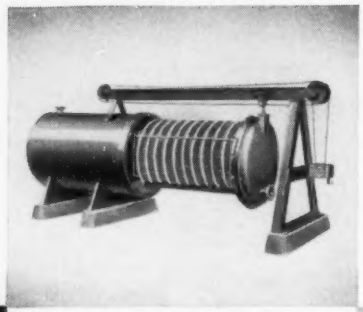


HORIZONTAL FILTERS

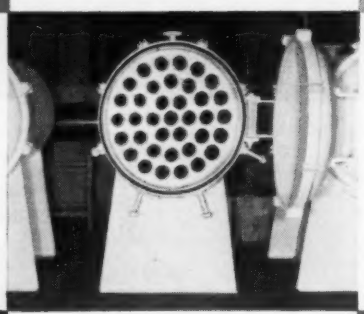
Highly efficient with capacities up to 1950 sq. ft. of filtering area. Simplifies recovery of filter cake. "Lift-out" leaves make maintenance and cleaning easy.

BULLETIN HH-155

TUBULAR FILTERS

New operating ease for smaller filtration problems. Ideal for polishing liquids, as a trap filter and as a scavenger for larger filters.

BULLETIN 75-160-755



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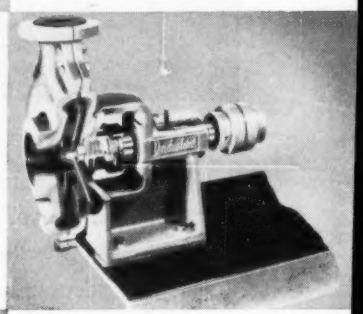

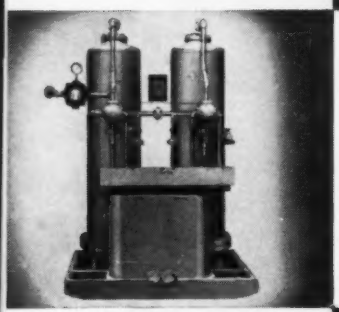

ION EXCHANGERS

With operating costs figured in pennies per thousand gallons, Industrial ion exchangers are specially built for water purification, waste treatment, metal recovery and other solution treatments.

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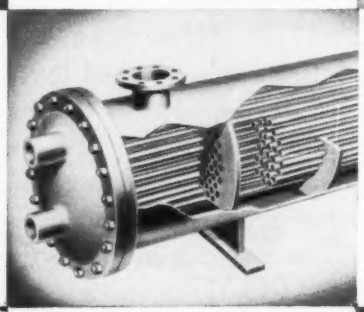

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For corrosive or non-corrosive liquids and gases. Industrial builds these to suit the job and can furnish all auxiliary pumps, piping and fittings.

BULLETIN 600-2-354

WATER SOFTENERS

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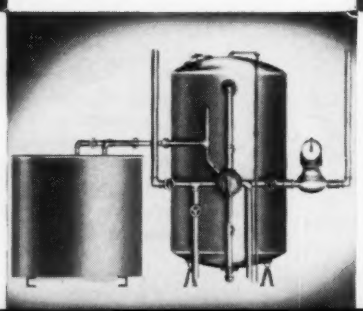

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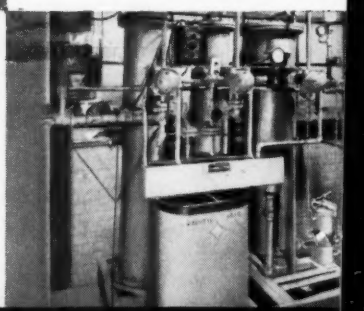
For recovery, or destruction of chemicals for disposal. Many Industrial recovery systems have paid out their cost in a few months. Complete service from solution analysis to installation.



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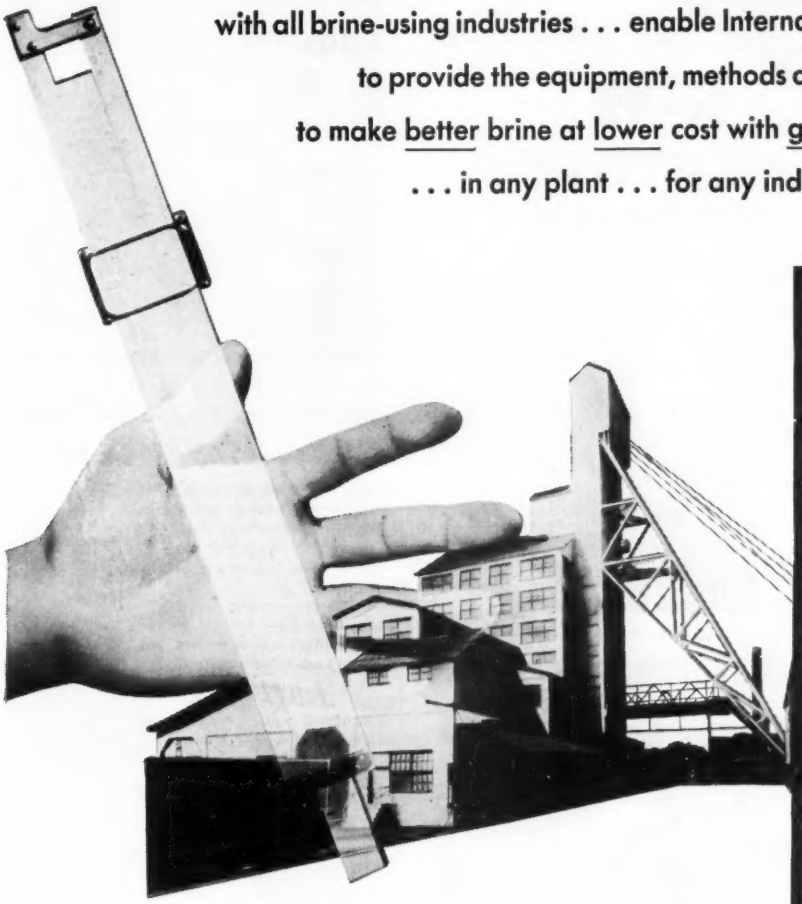

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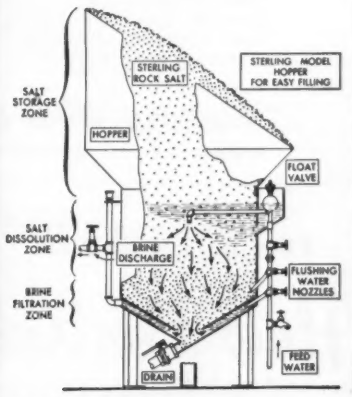

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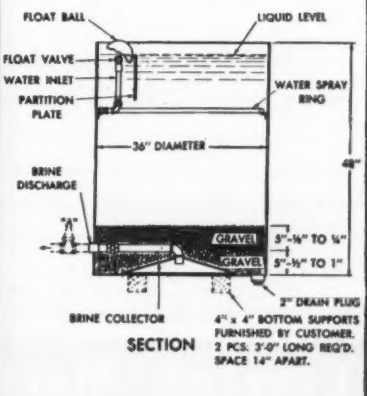

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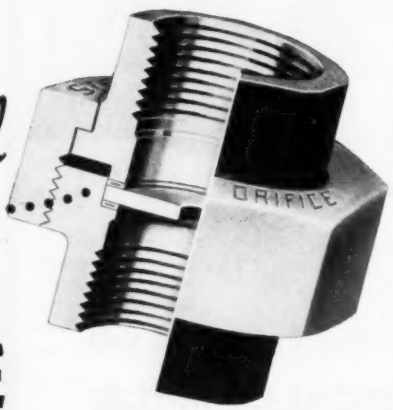

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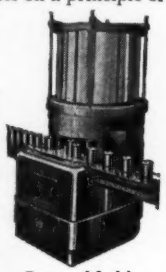

Rotary Model

Semi-automatic models are available for filling containers ranging from the tiny talcum box up to and including 100 lb. paper bags and 200 lb. drums. Rotary models are available for automatic production of 5 lb. sizes or less at speed of 45 to 300 per minute.

Model E

Pneumatic is the one manufacturer in a position to furnish machines for making up complete production lines. Units are available for air cleaning, powder and liquid filling, capping and labeling a wide range of bottles, cans or jars.

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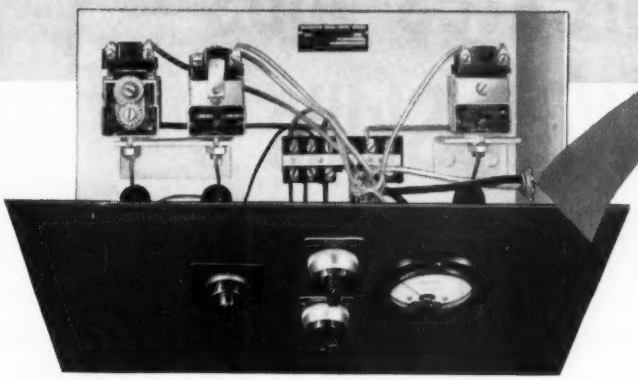
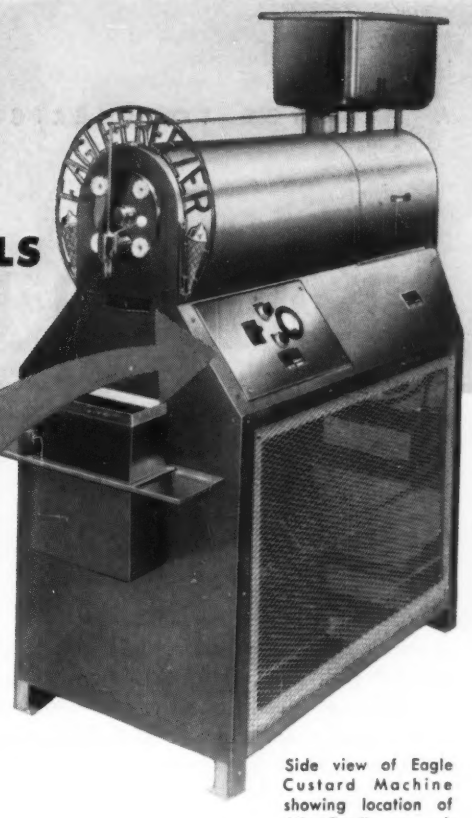
EAGLE CUSTARD MACHINE

factory equipped with

ALLEN-BRADLEY AUTOMATIC MOTOR CONTROLS



Close-up of Allen-Bradley control panel with knob controls. At left is setting knob for thermostat control. In center, upper knob controls beater motor; the lower knob controls the compressor motor.



Side view of Eagle Custard Machine showing location of Allen-Bradley panel.

Allen-Bradley Quality Controls assure trouble free performance without contact maintenance

The Eagle Machine & Tool Co. solved their problem of providing accurate and reliable controls for their custard machines by using a special control panel supplied by Allen-Bradley.

Since temperature and pressure must be accurately regulated in custard production, Allen-Bradley Bulletin 836 high and low pressure automatic pressure switches are mounted on the control panel. For critical temperature control, an Allen-Bradley Bulletin 837 temperature switch with a manual adjusting knob is used.

These three controls automatically open and close the two Allen-Bradley solenoid motor starters that are mounted on the back of the custard machine.

When you have a motor control problem, call in your nearest Allen-Bradley sales engineer. Let him study your requirements for either manual or automatic control. He is at your service. Remember . . . the Allen-Bradley trademark is a sales asset to any motorized machine. It is the sign of QUALITY motor control.

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The Sign of
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ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
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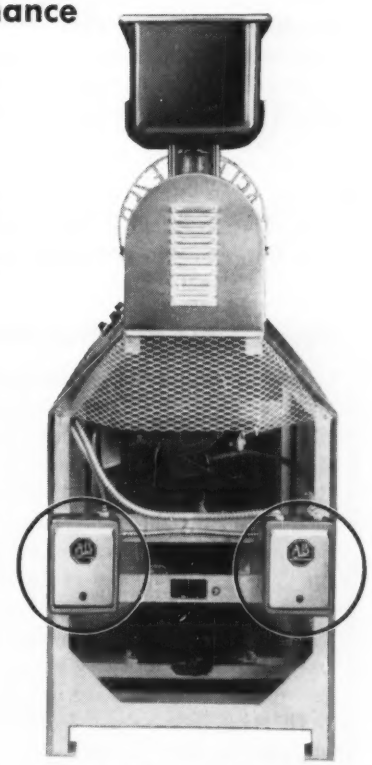


Rear view of the custard machine, showing the Allen-Bradley Bulletin 709 automatic starters for the beater and compressor motors.

Automation Creates Jobs For Workers With Skills

There is new and reassuring information for those who fear that "automation" – the control of machines by machines – will mean fewer job opportunities. It comes from a special survey of 1,574 companies in metalworking industries recently completed by AMERICAN MACHINIST, a McGraw-Hill publication. More than one-fifth of the companies reported that they already have automatic loading, transfer or assembly machinery in operation. In these companies as a whole there has been a net increase in total employment since this machinery was installed.

According to the AMERICAN MACHINIST survey, of these companies with actual experience in automation

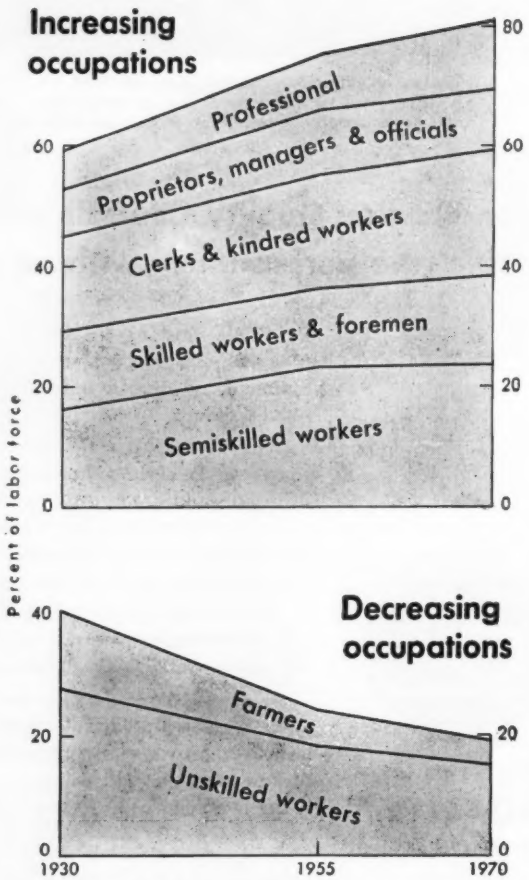
- 26% reported increases in employment averaging 21%
- 51% reported no change in total employment
- 23% reported decreases in employment averaging 16%

More Jobs for the Skilled

Of greater significance, however, is the response by 40% of these companies that they required more skilled maintenance men and by 21% of the companies that they had increased their engineering staffs. This indicates that automation is strengthening a trend already evident in the United States, a trend of expanding opportunity for those with industrial and professional skills and, relatively, of contracting opportunity for the unskilled.

The following chart shows how strong this trend has been over the past 25 years and how strong it may be expected to be over the next 15 years.

There has been a sharp decline in the percentage of unskilled workers in the nation's labor force and a corresponding increase in the percentage of those with varying degrees of skill.

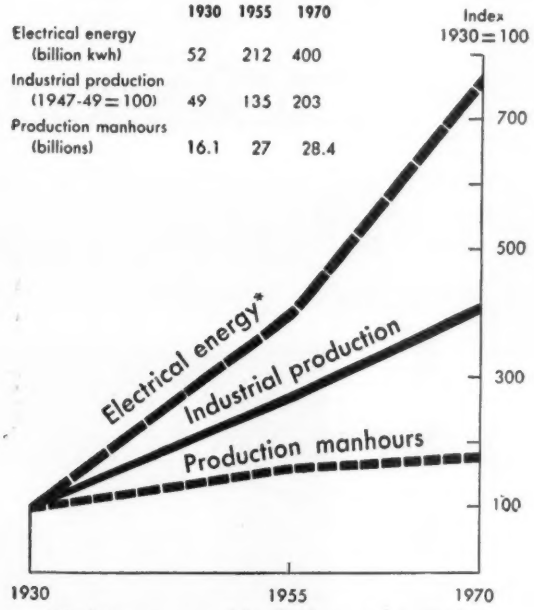


It is possible, of course, to cite cases of individuals and groups that do not conform to the charted trends. Farmers, for example, are becoming at the same time more skilled and less numerous. But this does not upset the broad proposition that opportunities are increasing for those who have skills.

Power and Production

Much of the basic explanation for the relative expansion of opportunities for those with industrial and professional skills lies in the increasing use of power-driven machinery. This has made possible a vastly greater increase in manufacturing production than in the manhours of human labor devoted to it. The following chart shows the relative increases in electrical energy and manhours of labor used in manufacturing since 1930 and the rise in industrial production.

	1930	1955	1970
Electrical energy (billion kwh)	52	212	400
Industrial production (1947-49 = 100)	49	135	203
Production manhours (billions)	16.1	27	28.4

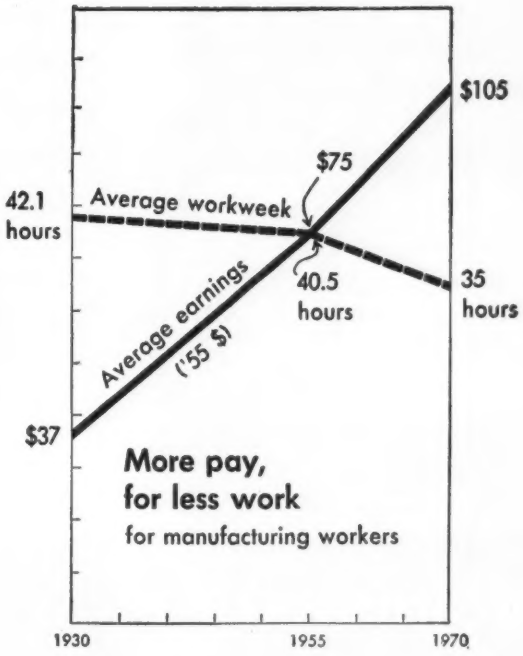


*Excludes power used in aluminum and magnesium reduction, both very heavy power users.

Power-driven machines have reduced the amount of human energy required for physical labor, but they have increased the need for skillful handling and maintenance. As the AMERICAN MACHINIST survey demonstrates, the same is true of automatically controlled machinery.

Higher Wages, More Leisure

The rising average wage of American industrial workers and the decline in hours per week that they must work reflect directly the extent to which the increase in industrial production has outstripped the manhours devoted to it. The final chart shows the increase in weekly wages (in dollars of constant purchasing power) and the decrease in the average workweek in manufacturing since 1930. It also shows the changes that may come in the next 15 years if present trends continue.



There are some who would slow what an earlier editorial in this series characterized as "the continuing process of taking dull and laborious work off the backs and minds of men and transferring it to machines operating in large batteries under automatic control." In doing so, they might make the world safer for those with no skill. The far more constructive course is to welcome the expanding opportunities now being provided and be sure that the nation's young people, who are now starting another school year, are prepared to take advantage of them.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments that are of particular concern to the business and professional community served by our industrial and technical publications.

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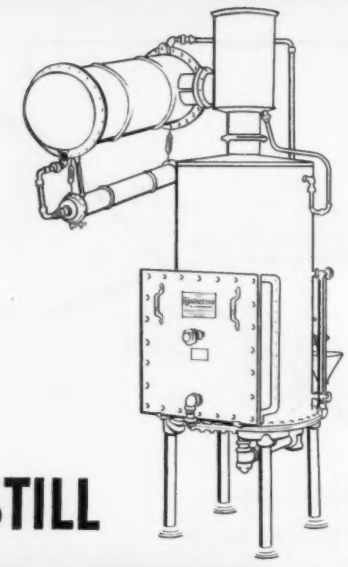
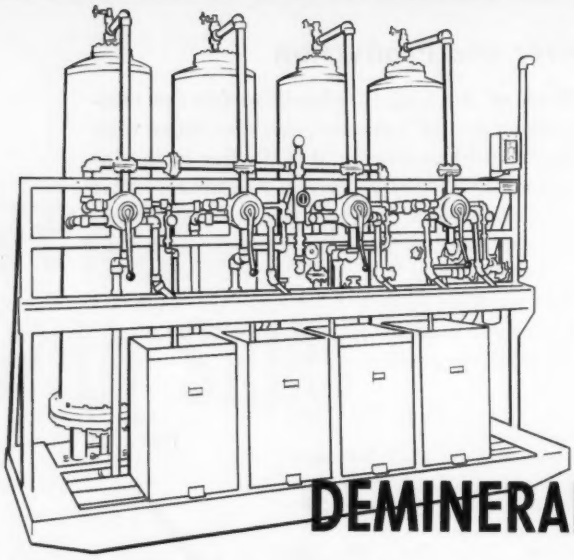


STILL



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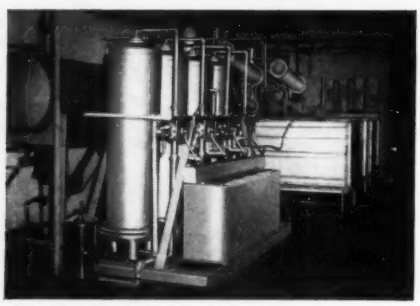

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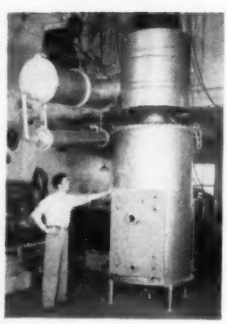

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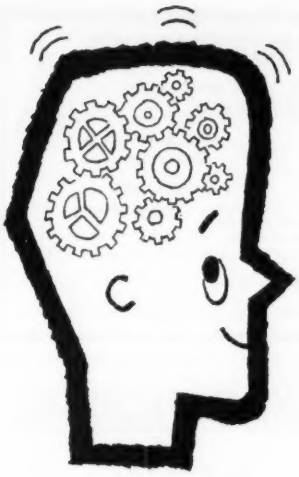

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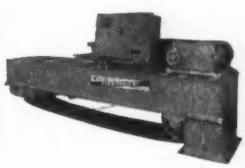
4. MW PLASTICOTE LINING — Applied to hot water tank interiors — eliminates rust — passes inspection.
5. SURFACE CLEANING — Sand and Steel Grit Blasting in the large MW blastrooms or in the field.

CONSULT BEFORE YOU SPECIFY
Send Us Facts or Ask for Literature!

PROTECTIVE COATINGS DIVISION
MW METALWELD, INC.
Scotts Lane & Cresson Ave.
Phila. 29, Pa. - Victor 8-1810



FEED MATERIAL BY WEIGHT

MERRICK FEEDOWEIGHT

MERRICK SCALE MFG. CO.
171 SUMMER ST., PASSAIC, N. J.

CHEMSTEEL CONSTRUCTION COMPANY, INC.
501 Chemsteel Bldg., Walnut St., Pittsburgh 32, Pa.

Send data on Engineering & Construction facilities for
ACID-ALKALI-PROOF CONSTRUCTION
of processing & storage tanks & flooring.

NAME .....
COMPANY .....
ADDRESS .....
CITY .....ZONE.....STATE....

EMPLOYMENT OPPORTUNITIES

The Advertisements in this section include all employment opportunities—executive, management, technical, selling, office, skilled, manual, etc.

Positions Vacant
Positions Wanted
Part Time Work

Civil Service Opportunities
Selling Opportunities Wanted
Selling Opportunities Offered

Employment Agencies
Employment Services
Labor Bureaus

DISPLAYED —RATES— **UNDISPLAYED**

The advertising rate is $23.25 per inch (effective Jan. '56) for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on a column—3 columns—30 inches to a page.

Subject to Agency Commission.

$1.80 per line, minimum 3 lines. To figure advance payment count 5 average words as a line.

Box Numbers—counts as 1 line.

Discount of 10% if full payment is made in advance for 4 consecutive insertions.

Not subject to Agency Commission.

Send NEW ADS to CHEMICAL ENGINEERING, 33 W. 42nd St., N. Y. 36, N. Y. for December issue closing November 2nd.

CHEMIST or CHEMICAL ENGINEER

We have several positions available to graduates interested in laboratory, development, compounding or production end of the rubber business. Our expansion plans offer real potential and we would like to present our program to you on a confidential basis. Ohio location. In reply, state age, education and experience.

P-8006, Chemical Engineering
520 N. Michigan Ave., Chicago 11, Ill.

SANITARY ENGINEER

Opportunity available for Sanitary Engineer in an expanding pulp and paper mill located in the Middle Atlantic States. Age 25-35 years. Require man experienced in Paper Mill wastes. Paper Mill stream pollution and Paper Mill Water purification. No other experience will be given consideration. Good salary and advancement. Send resume of educational background and industrial experience. All replies confidential.

P-6998, Chemical Engineering
330 W. 42 St., New York 36, N. Y

CHEMICAL ENGINEERS

An active, confidential service! Interview at your convenience.
Call, write or wire
GLADYS HUNTING (Consultant)
DRAKE PERSONNEL, INC.
220 So. State St. Rm. 628 Chicago 4, Ill.
HArrison 7-8600

CHEMICAL ENGINEERS

$8,000 to $15,000

Are you seeking that once in a lifetime opportunity with a national organization that spares no expense to obtain results? If you have experience in rubber, plastic or resins you qualify. Write us in strict confidence.

MONARCH PERSONNEL
28 E. Jackson Chicago 4, Illinois

CHEMICAL ENGINEERS

M.S. or Ph.D.—Project & Process Design

Need 1—10-15 yrs exp To $1100 Mo
Need 3— 5- 8 yrs exp To $ 850 Mo
Need 4— 3- 5 yrs exp To $ 600 Mo

CONTACT BOB POORE
O'SHEA EMPLOYMENT SYSTEM
"America's Largest"
64 E. Jackson, Chicago, Ill. Tel. WAbash 2-1884

CHEMISTS—CHEMICAL ENGINEERS

B.S. to Ph.D. Beginners—Experienced
We place EXCLUSIVELY with
Chemical Companies
Call—Come In—Send 5 résumés
SELECTIVE PLACEMENT
EMPLOYMENT AGENCY
17 William Street Newark, N. J.
C. A. Reed Jr., M.St. S. Goodman, M.Sc.

CHEMICAL ENGINEERS

MID-WEST

Major expansion of operations will provide opportunities for chemical engineers interested in production and pilot plant fields. Also openings for chemical engineers with approximately 5 years experience in engineering design. Applicants must be eligible for AEC clearance. Resumes will be treated in confidence and should be directed to

PW-7942, Chemical Engineering
520 No. Michigan Ave., Chicago 11, Ill.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

Wanted: Graduate chemical engineer for assistant plant manager in chemical plant. Applicant must be under 32 years of age and have two years experience in distillation and reaction processes. Contact: Synvar Corporation, 415 East Front Street, Wilmington, Delaware.

Position Open—Chemist or chemical engineer must be familiar with the application and testing of Organic finishes. Should have experience in shading. Must be familiar with the operation and control of phosphate coating equipment, pickle equipment etc. Must have both laboratory and plant experience. Provide personal and experience data, and address the Asst. Manager of Engineering, Gibson Refrigerator Company, Greenville, Michigan.

Position open for Chemical Engineer, 25-35 years of age, in branch operation of medium-sized company engaged in non-metallic mining, refining and processing. Must be capable of assisting the plant superintendent in all phases of the operation. Experience in both production supervision and pilot plant work not essential, but considered to be good background for this position. Considerable opportunity exists for capable, aggressive person. Salary open. Location Southwest U.S.A. P-7823, Chemical Engineering.

Chemical Safety Engineer technically trained safety engineer with chemical plant experience wanted to head up safety, fire protection, and plant security, in heavy chemical plant in West Virginia. Fine opportunity to exercise initiative and organizing ability, with free hand to do what's needed. Please state experience and desired salary range in reply. P-7782, Chemical Engineering.

Process Engineer—Engineering graduate experienced in the process design of various types of petroleum refining process units required by a midwestern engineering and construction firm. Please submit resume and photograph indicating education, experience, and salary requirements to P-7781, Chemical Engineering.

POSITION VACANT

Assistant to Manager—Fin-Tube Coil Sales leading manufacturer of air conditioning, heating, ventilating and heat transfer equipment has an opening for a graduate engineer interested in sales management. The man accepted will assume diversified duties in engineering sales and business administration. Two or three years' experience with heat transfer equipment and/or fluid flow desired. Send detailed resume of education, experience and salary desired to Manager of Staff Employment, The Trane Company, La Crosse, Wisconsin.

SELLING OPPORTUNITY OFFERED

Exclusive Agencies and distributorships available in most areas for handling range of new patent straight-through diaphragm valves. Manufacturers representatives invited to apply, giving present lines and territory covered. Write Stockdale Engineering Co., Box 144, Haddonfield, New Jersey.

EMPLOYMENT SERVICES

Salaried Positions $5,000 to $35,000. We offer the original personal employment service (established 45 years). Procedure of highest ethical standards is individualized to your personal requirements. Identity covered, present position protected. Ask for particulars. R. W. Bixby, Inc., 653 Brisbane Bldg., Buffalo 3, N. Y.

Salaried Personnel. $5,000-$35,000. This Confidential service established 1920, is geared to needs of high grade men who seek a change of connection, under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. L, P. O. Box 674, Manchester, Vermont.

LEGAL NOTICE

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233)
SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION

Of Chemical Engineering published monthly at Albany, New York for October 1, 1955.

1. The name and address of the publisher, editor, managing editor, and business manager is: Publisher, McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York 36, N. Y.; Editor, John R. Callahan, 330 West 42nd Street, New York 36, N. Y.; Managing editor, Lester B. Pope, 330 West 42nd Street, New York 36, N. Y.; Business manager, Anton J. Mangold, 330 West 42nd Street, New York 36, N. Y.

2. The owner is: McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York 36, N. Y.; Stockholders holding 1% or more of stock: Donald C. McGraw and Willard T. Chevalier, Trustees for Harold W. McGraw, Donald C. McGraw and Elizabeth M. Stoltzfus, all of 330 West 42nd Street, New York 36, N. Y.; Donald C. McGraw and Harold W. McGraw, Trustees for Catherine M. Rock, 330 West 42nd Street, New York 36, N. Y.; Donald C. McGraw, 330 West 42nd Street, New York 36, N. Y.; Mildred W. McGraw, Madison, New Jersey; Grace W. Mehren, 536 Arenas Street, LaJolla, California; Touchstone & Company, c/o Wellington Fund, Inc., Claymont, Del.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

McGRAW-HILL PUBLISHING COMPANY, INC.
By J. A. GERARDI, Vice Pres. & Treas.

Sworn to and subscribed before me this 15th day of September, 1955.
[SEAL] ELVA G. MASLIN.
(My Commission expires March 30, 1956)

NEED ENGINEERS?

An employment advertisement in this EMPLOYMENT OPPORTUNITIES section will help you find the engineers you need. It's an inexpensive, time saving method of selecting competent personnel for every engineering job in the chemical process industries. The selective circulation of CHEMICAL ENGINEERING offers you an opportunity to choose the best qualified men available.

ENGINEERS

MAJOR EXPANSION

Creates Promising Positions

Aeronautical Engineers
Chemists
Chemical Engineers
Mechanical Engineers
Physicists

Stimulating jobs with a future in Combustion Research and Development . . . Applied Research, Development Engineering, Evaluation, Fundamental Engineering and Program Planning.

At General Electric's Aircraft Gas Turbine Development Department, there is a major permanent expansion, creating permanent positions with career possibilities as big as your own abilities. If you have a B S, M S or Ph D, and would like to work for an established industrial leader, get in touch with us. Opportunities for those with or without industrial experience in the areas of Burner Design, Combustion, Fuels, Fluid Flow, Heat Transfer and Thermodynamics.

Please send resume to:

Mr. D. R. LESTER
Aircraft Gas Turbine Division—Evendale Plant

GENERAL ELECTRIC

Cincinnati 15, Ohio

WANTED

MECHANICAL ENGINEER

for plant engineering and design, college graduate, five or more years' experience in industry for modern expanding heavy chemical manufacturer in Ohio Valley, West Virginia panhandle.

P-7844, Chemical Engineering
330 W. 42nd St., New York 36, N. Y.

IMPORTANT TEACHING POSITIONS OPEN IN ISRAEL

Technion, Israel Institute of Technology in Haifa, Israel, proposes to appoint:

Professor of Mathematics
Professor of Physical Chemistry
Professor of Chemical Engineering
Professor of Applied Biology

Applicants should have first-rate professional and academic qualifications, be willing to integrate themselves into the life of the country and, in due course, to teach in Hebrew.

Applications with full details should be sent in duplicate, for transmission to Haifa, to the:

AMERICAN TECHNION SOCIETY
1000 Fifth Avenue New York 28, N. Y.

Outstanding Opportunity

FOR YOUNG SCIENTISTS

- Chemical Engineers...
- Organic Chemists...
- Physical Chemists...
- Mechanical Engineers...

One of the world's largest manufacturers of man-made fibers has an opportunity for young scientists. Its principal production is cellulosic fibers, but its extensive research facilities constantly explore the entire field of man-made fibers.

Courtaulds (Alabama) Inc. has a new production plant and research facilities in Mobile, Alabama. It is anxious to obtain several young men who have not placed a ceiling on their professional attainment. The Company wants young men of proven scholarship and unlimited ability to grow. The opportunity for advancement is great because the Mobile operation is young and the staff is still quite small.

Courtaulds needs four CHEMICAL ENGINEERS whose interests are in the direction of plant technical problems or research. These men should be recent honor graduates, with a desire to further their professional growth in a substantial company which is sympathetic to academic and professional attainment. An opportunity can be provided for such young scientists to associate with some of the outstanding people in the man-made fiber field.

Courtaulds needs the same type of scientists in ORGANIC CHEMISTRY and PHYSICAL CHEMISTRY, and can provide the same opportunities as noted above.

MECHANICAL ENGINEERS are needed in the Engineering Department for design work on new plant and modifications calling for a great deal of automation.

Qualification standards for all appointments are extremely rigid, because the opportunity for growth is great and the remuneration is comparable.

Send full particulars to:

Director of Industrial Relations
COURTAULDS (Alabama) Inc.
P. O. Box 1076
Mobile, Alabama.

OPPORTUNITY

In Eastern Pennsylvania

CHEMICAL • MECHANICAL ENGINEERS

The leading company in the field of engineering design, manufacture and construction of oxygen generators and low temperature processing plants offers junior to management positions to carefully selected engineers who desire to participate in a rapidly growing field serving metallurgical, chemical, and petroleum industries. Staff of 150 engineers and 600 workers in three factories.

Mechanical — Chief, Intermediate, Junior

Development, design, manufacture, tests on rotating and reciprocating machinery, stress analysis, bearings, lubrication, thermodynamics, aerodynamics, fluid flow and kinetics combined with mechanical aptitude and natural ability. Chief engineer must have at least 10 years experience.

Project — Senior, Intermediate, Junior

Chemical or mechanical engineers with major experience or interest in chemical or process equipment and plants design and construction. Practical application of thermodynamics, fluid flow, heat transfer, distillation, fluid separation processes, piping, control and instrumentation combined with strong mechanical sense and ability to coordinate a project from contract to completion.

Pressure Vessel Designer

Senior engineer to supervise and design pressure vessels of carbon and stainless steels, aluminum and copper to ASME code. Minimum of five years experience. Must be thoroughly familiar with codes, welding details, and manufacturing methods.

Chemical Engineers

Process Design
Economic Evaluation and Estimating
Research and Development

The process and research and development engineers must have maximum strength in chemical engineering thermodynamics, fluid flow, heat and mass transfer, distillation, and physical fluid separation processes, combined with originality and creative ability for the separation of complex mixtures of low molecular weight gases by low temperature means. The research and development engineer must also be an experimentalist. The economics and cost engineer must combine many of the above qualifications with a strong interest in cost and economic factors.

Sales Engineer — Junior

Chemical engineering background with at least two years' experience with the process or metallurgical industries with strong desire and aptitude for high level sales. Will assist on staff while training.

Manufacturing Engineer

To prepare detailed manufacturing processing instructions for pressure vessels, heat transfer, and process equipment. Experience in machine shop practices, sheet and light structural fabrication, copper smithing, tooling and jigs. Liaison with engineering and manufacturing.

Highest salaries commensurate with training and experience. Profit sharing and other benefits. This is an excellent opportunity for engineers with above average ability and initiative to progress in the rapidly expanding new field of low temperature processing. Applications will be treated in strict confidence and should be complete—education—experience—interest and other information which will help us to understand and evaluate you. Write to B. H. Van Dyke

AIR PRODUCTS INCORPORATED

P. O. Box 538 Allentown, Penna.

Plant Engineer

Graduate Mechanical or Chemical Engineer needed with minimum of five years project engineering experience dealing with process equipment, construction, estimating, design, utility analysis, and maintenance to supervise plant engineering and maintenance function of a large expanding Resin, Varnish, Wire Enamel and Paint Plant located in upstate New York.

Reply giving full details of experience, education, earnings and salary requirements.

P-7879—Chemical Engineering, 330 W. 42nd St., New York 36, N. Y.

SALES ENGINEER

Are you interested in a sales engineering position in the field of instrumentation and automation? We are looking for chemical engineering graduates 25 to 35 years of age for Knoxville, Tennessee and Charleston, West Virginia. Must be willing to locate here and travel adjacent territory.

Compensation on straight salary basis, all expenses paid and car furnished with liberal fringe benefits. Sales experience desirable, but not necessary as we provide Klein Sales Aptitude Test at our expense.

Successful applicants will receive thorough training course at our factory, Foxboro, Massachusetts before being assigned to branch office.

If you are interested in a real opportunity with a progressive organization, please write A. H. Shafer, The Foxboro Company, 2270 Noblestown Road, Pittsburgh 5, Pa. sending complete resume of education and past experience.

MANUFACTURERS REPRESENTATIVE

Agents for Metropolitan New York—New Jersey, Chicago, St. Louis, and Florida areas to sell Fluid Mixing Equipment to chemical, petroleum, drug and food industries.

CHEMINEER, INC.
1044 East First Street Dayton 2, Ohio

Wanted
CHEMICAL ENGINEER:

For process development and production work. Two to five years' experience preferred. Modern expanding chemical manufacturing plant in West Virginia's Ohio River Valley section. Engineering now in progress for several new products. Modern research and development facilities now being constructed. Excellent opportunities.

P-7349, Chemical Engineering
520 N. Michigan Ave., Chicago 11, Ill.

OPPORTUNITY FOR
CHEMICAL PROCESS EQUIPMENT ENGINEER

Unusual opportunity for one with ambition to join a small but long-established and progressive firm in a friendly New England community. This company has the diversification of three product divisions that are nationally known and has recently added and is now expanding a newer division manufacturing processing equipment with commercial installations proven in a number of different industries throughout the United States. There is an attractive future for a recent chemical engineering graduate with a few years' practical experience.

P-7917, Chemical Engineering
330 W 42nd St., New York 36, N. Y.

EXCLUSIVE TERRITORIES AVAILABLE

For firms or individuals to sell and service leading manufacturers complete line of

Corrosion Proof Materials and Construction

On Commission Basis. Locations Available: Alabama, Carolinas, Georgia, Minnesota, Missouri, Virginia, Kansas.

RW-4227, Chemical Engineering
520 N. Michigan Ave., Chicago 11, Ill.

CHEMIST OR ENGINEER

With leanings toward Physical Chemistry and an affection for short-and long-term laboratory problems. Recent graduate or a few years' experience at the Bachelor level desired.

P-7976, Chemical Engineering,
330 W. 42nd St., New York 36, N. Y.

CERAMIST or PHYSICAL CHEMIST

With strong interest in research involving high temperature solid state reactions between unusual ceramic materials, to participate in program to develop ceramic components for atomic energy uses. Advanced degree or experience desirable. To work in modern laboratories with excellent facilities.

Reply to Manager,
Salaried Personnel Administration,

The Carborundum Company
Niagara Falls, New York

COMBUSTION ENGINEER

For research and development of gas & oil fired burner equipment for industrial processing. This is a newly created position with many interesting possibilities.

WESTERN PRODUCTS, INC.
P. O. Box 31 New Castle, Indiana

ENGINEERING ECONOMICS

Young chemical engineer with a flair for economic studies needed by a growth-minded eastern chemical company offering unusually attractive working and living conditions. This man will work on an expanding team reporting directly to top management. Some plant experience desirable, chemical engineering degree essential. Replies held in confidence. Send resumes, including salary history, to

P-7839, Chemical Engineering
330 W. 42nd St., New York 36, N. Y.

WANTED
TECHNICAL EDITORS

To provide for its continued growth Chemical Week is seeking two additional assistant editors — preferably chemists or chemical engineers with two to three years business experience. Essential: Ability to meet people, dig out facts, interpret them intelligently and write lucidly. Please submit resume to:

PERSONNEL DIRECTOR
McGRAW-HILL PUBLISHING CO.
330 W. 42ND ST.
NEW YORK 36, N. Y.

CHEMICAL MARKET RESEARCH

Our expanding consulting service to the chemical process industries means we have openings for young chemists and/or chemical engineers who are looking ahead. No market research training is necessary but some industrial experience is indicated plus an active interest in the economic and marketing phases of the chemical process industries. Obviously training or experience in market research would be available.

Roger Williams Technical & Economic Services, Inc.
148 East 38th Street, New York 16, New York Murray Hill 5-5257

SEARCHLIGHT SECTION

(Classified Advertising)

BUSINESS OPPORTUNITIES — EQUIPMENT - USED or RESALE

UNDISPLAYED —RATES— DISPLAYED

$1.80 a line (effective Jan. '56) minimum 3 lines. To figure advance payment count 5 average words as a line.

BOX NUMBERS count as one line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

The advertising rate is $16.95 per inch (effective Jan. '56) for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured 7/8 inch vertically on one column, 3 columns—30 inches—to a page.

EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

Send NEW ADVERTISEMENTS to N. Y. Office, 330 W. 42nd St., N. Y. 36, N. Y. for December issue closing November 3rd

BIG SAVINGS IN GUARANTEED EQUIPMENT

DRYERS & KILNS

Devine #12 & #23 Vac. Shelf Dryers.
1—Stokes 2' x 6' Rotary Vac. Dryer.
2—Albright-Neil 4' x 9' Atmos. Drum Dryers.
1—Buffalo Vac. Drum Dryer 24" x 20".

CENTRIFUGALS & CENTRIFUGES

4—Tolhurst 40" Suspended Type Centrifugals.
8—Centrifugals 12", 30", 40" & 48" Steel, Copper, Stainless & Rubber Lined.
6—Sharples Centrifuges #5A Stainless. Also #6.
3—De Laval Multiple Clarifiers #200, 300 & 301.

FILTERS

#2 Sweetland Filter 12 Stainless Covered leaves.
1—Vallez 41 Stainless Covered Leaf Filter, type 49.
Sperry & Shriver 12 ' to 36 sq. iron & wood.
Gen. Amer. 2' x 1' Rotary Vac. Filter.

KETTLES & TANKS

Pfaudler 250 & 500 gal. Glass Lined Ketties.
1—Dopp 350 gal. C.I. Jack. Vac. Kettle.
Devine & Stokes Impreg. Units 30" & 36" dia.
Devine 1000 gal. closed Jack. Steel Kettle.
1—2300 gal. vert. agit. Jack. Steel Kettle.
8—Jacketed Kettles 50 to 2300 gals.
1—250 gal. Lead-Lined Kettle.
2—500 gal. vert. Glass Lined Tanks.
50—Stainless Alum., Copper, Glass & Lead Lined Kettles & Tanks. Also new Stainless

PULVERIZERS & MILLS

3—Mikro Pulverizers #2SI, #2TH.
Patterson 30" x 42", 4' x 5' & 6' x 4' Pebble Mills.
Abbe 30" x 30" Pebble Mill.
Abbe 37" x 30" Chrome-Mann Ball Mill.
#1 Raymond Automatic Pulverizer 20 H.P. motor.
1—Raymond #00 Pulverizer 30 H.P. Complete
2—#0000 Raymond Mills.
Sturtevant #0.18" Hi-gat Hammer Mill.
Jeffrey 18" x 18" Single Roll Crusher.
Buchanan 5" x 12" Jaw Crusher.
Day Hercules Spike Crusher 1½ H.P. motor.
Hammer Mills & Pulverizers 3 to 50 H.P.
1—Schutz-O'Neil 20' Pulverizers. Also #1.
Williams #3 & 2xx Hammer Mills.
1—Robinson 18" x 22" Attrition Mills.
1—Lehman 4 Roll W.C. 12 x 36" Steel Mill.
3—Steel 3 Roll Mills 9"x32", 12"x30" & 16"x40".
1—Lehman 4 Roll W.C. 12 x 36" Steel Mill.
3—Houchin 18"x36"; 4 Roll Granite Stone Mills.
Ball & Jewell Rotary Cutters Lab. #1 & #2.
2—U. S. & Premier 1½ H.P. Colloid Mills.

MIXERS & SCREENS

Lancaster 6' dia. Vert. Mixer 25 H.P.
Baker Perkins double arm 100, 50 #9 gals.
2—Read 50 & 100 gal. double arm mixers.
Kent 3 HP. Continuous Dry Mixer.
Horiz Mixers single & double arm to 200 gal.
3—Day 8, 15 & 40 gal. Pony Mixers.
Read 40 and 80 qt. vertical Mixers.
6—Lead — Paste Mixers 50 to 150 gals.
Tyler 3'x5' Vibratory 2 Deck Screen. Other sizes.
Blystone 3000# horiz. spiral mixer.
10—Dry Spiral Mixers 50 to 3000#.
12—Portable Elec. Agitators ¼ to 3 H.P.

MISC. & SPECIAL

Banbury size B lab mixer.
Thropp lab rubber or plastic mill.
Kux 2½" single punch Preform Machine.
Belt Conveyors 12", 15' & 20' long.
Anderson & French Oil Expellers.
Gould 75 HP Centrifugal Pump. 250 PSI.
1—Marco 200 Stainless Steel Homogenizer.
Filling Machines powder, paste & liquid.
Rotary & Single Punch Tablet Machines, ½" to 4".
1—Howe Mogul Barrel & Bag Packer.
2—Worthington 12" x 12" x 12" Vac. Pumps.
6—Devine Stokes & Buffalo Vac. Pumps.
Soap Machinery for: Toilet, Laundry, Chip, Liquid.
Plastic & Rubber Mills, Calenders, Hydr. Presses.
Inject. Mold Equipt. Extruders, Banbury Mixers.

NEW TANKS, STAINLESS & CARBON STEEL, BUILT TO YOUR SPECIFICATIONS
WE BUY YOUR SURPLUS MACHINERY & COMPLETE PLANTS
PARTIAL LISTING, WRITE FOR BULLETINS

STEIN EQUIPMENT COMPANY

107 - 8th St., Brooklyn 15, N. Y. *Sterling 8-1944* *Cable Machequip*

FOR SALE

1500 gal. Vert. S.S. Tank, agit.
60" Centrifugal Extractors, Type #316 S.S.
42" x 120" Buflovak Double Drum Dryer.
50 to 200 gal. S.S. Mix Tanks, water jkt.
300 gal. Horiz. S.S. Tank, 3' x 7', agit.
650 gal. Horiz. S.S. Tank, 4' x 7', agit.
1800 gal. Stainless Steel Truck Tank.
5 ft. S.S. Vacuum Pan with accessories.
200 & 750 gal. Pfaudler Reactors.
60 gal. Groen S.S. Clad Jkt. Kettles.
12" Bronze Filter Press, 40 disc slots.
50 to 1,500 gal. Homogenizers or Viscolizers.
26" Centrifugal Extractors, copper baskets.
30 ton Howe Suspension Tank Scale.
3—#10BB Waukesha Pumps, 1 H.P.
#25BB & #55BB Waukesha Pumps.
Frick Evaporative Amm. Condenser, 20 tons.

Send us your inquiries

LESTER KEHOE MACHINERY CORP.
1 East 42nd Street New York 17, N. Y.
MUrray Hill 2-4616

FOR SALE

Complete Crystallizing and Filtering Unit installed 1951, used on Epsom Salts, capacity 1670 lbs. crystals per hr.
Swenson Continuous Rubber Lined Vac. Cooling Crystallizer.
Feinc 6' dia. Horiz. Filter S/S and Steel Construction.
Shriver 30" plate & frame Filter Press.
2100 Gal. S/S Horiz. Tank; Pumps; Tanks; Kettles.

All units in very good condition.

We buy your surplus.

THE MACHINERY & EQUIPMENT CORP.
533 West Broadway New York 12, N. Y.
GRamercy 5-6680
HARRY PEARLMAN, Pres. BILL WOLF, Vice-Pres.

WE NEED

All Kinds of Oil Refinery and Chemical Equipment, also Tanks

Write — Wire — Phone

Weinstein Co., Div. of Surplus & Salvage Co., Inc.
610 West 8th Street Jamestown, New York

WANTED—SURPLUS

Chemicals—Dyes—Drugs
Colors—Pigments—Oils—Waxes
By-Products—Wastes—Equipment

CHEMICAL SERVICE CORP.
80-04 Beaver St. New York 5, NY

AVAILABLE

CUSTOM REFINING FACILITIES . . .

- Complete Distillation Service • Distillations
- Extractions • Fractionations Drum Lots—Tank Cars

WANTED

- All Types of Crude Mixtures
- By-Products, Residues, Wastes
- Contaminated Solvents

Trulana CHEMICAL & ENGINEERING CO., Inc.
Box 426, Union, N. J. MUrdock 6-5252

Box 426, Union, N. J. Murdock 6-5252

LIQUIDATION

Purchased 1953 Used 30 Days*

TANKS

1—Pfaudler 5'x18' Horiz. glass lined 2500 gal.
1—Pfaudler 78"x96" Vert. Glass lined 2300 gal.
2—1500 gal. 316 S/S 5'x9' Vert. 20 PSI.
1—7500 gal. 316 S/S clad 12'x6'x5'6" cone.
1—750 gal. 316 S/S 5'x5' cone bottom.
3—4' diam. 316 S/S Conical Hoppers.
2—3'x32" 316 S/S Conical Hoppers.
1—2'x3' Horizontal Closed 316 S/S.
1—2½'x3½' Horizontal Closed 316 S/S.
2—3'x3½' Horizontal Closed Nickel Clad.
2—7'x11' Vert. Steel Brick & Lead lined.
1—7'x7'4" Vert. Steel Brick & Lead lined.
1—6'x6' Vert. Steel Brick & Lead lined.
1—4'x5'6" Vert. Steel Brick & Lead lined.
4—4'x8' Hor. Steel ASME 25 psi.
1—4'x5'x6" Hor. Steel ASME 25 psi.
2—3'x7' Vert. Steel ASME 25 psi.

PUMPS—CENTRIFUGAL

1—Lawrence Vert. 316 S/S 70 gpm 157' hd 20 HP
1—Lawrence Vert. 316 S/S 55 gpm 107' hd 7½ HP
2—Lawrence Vert. 316 S/S 50 gpm 107' hd 5 HP
3—Karbate Series 5A 60 gpm 60' hd 5 HP
9—Karbate new Impellers
1—I.R. 1000 gpm Series 5CRVL 40 HP
2—I.R. 1000 gpm Series 5CRVL 30 HP
2—I.R. 650 gym Series 5CRVL 30 HP

CONVEYORS

3—Link Belt 316 S/S 18"x12", 18"x10', 18"x7' twin screw
1—Link Belt Steel 10"x16' twin screw
9—Link Belt 12" Troughing Belt Conveyors 15', 20', 30', 35', 45', 50' open and closed with drives and motors.

REACTOR—CONDENSERS

3—4'x13' closed 316 S/S Reactors or Converters with 109-3"x6' 316 S/S tubes 150 psi
1—Pfaudler 250 gal. Hastelloy C. Reactor
2—Pfaudler Monel Heat Exchanger 62 sq. ft.
9—Karbate Heat Exchangers 370, 188, 70, 16.4 sq. ft.

DRYERS

1—Buflovak 6'x5'6" Monel Drum Flakers NEW with drives and motors
1—Rietz 30' "Thermoscrew" Conveyor Dryer 304 S/S NEW with drive & motor

MISCELLANEOUS

1—I.R. Jet Refrigeration Unit complete 208 Tons 65.5° F. to 60° F.
1—I.R. Jet Refrigeration Unit complete 136 Tons 50° F. to 45° F.
1—Patterson 7'6" Conical Blender Rubber lined with drive & 15 HP motor
20—Link Belt Reducers and drives from ¾ HP to 15 HP

* All motors are 3/60/440 V. explosion proof.

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6 Yeast Tanks w/Copper Coils & Agitators
Louisville 24" Press w/Endless Filtering Belt
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S. S. Dump Tanks, Copper Pipe & Valves, Blowers
Pumps & Motors, Steel Tanks w/Copper Coils & Paddle Agitators, Autoclave, Copper Jacketed Kettles, Port. Elec. Agitator Mixers, S. S. Motor Pumps & Etc.

TANKS

4—S. S. Tanks, 2000 Gal. Cap.
8—High & Low Copper Wine Tanks—2500 to 5500 Gal. Cap.
9—Fusel Oil & Reflex Copper Tanks—100 to 1350 Gal. Cap. Distilled Water Tank, Copper Lined—6500 Gal. Cap.
31—Cypress Wood Stave Tanks—8000 to 25000 Gal. Cap.

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Karl Kiefer Automatic 72 Spout Bottle Washer
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Karl Kiefer Pulp Filters
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BP 100 gal. SS Mixer, 20 HP Exp mtr.
Raymond #40 SS Imp Mill, 40 HP mtr.
Roto Louvre SS 5'x20' Rotary Dryer
Day 5 gallon SS Jktd Mixer, sigma arms
Gen. American 42" x 120" Twin Drum Dryer
Mikro Pulverizer #4 with 40 HP mtr.
Oliver Filter 8'x8', Acid Resistant, 15 HP
Hersey 4'x30' S/S rotary dryer, complete

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2—Blaw Knox ½ gal. St. St. agit. 2000# Pr.
3—St. St. T347, 13 gal., 1400# test, 50# jkt.

CENTRIFUGALS

1—AT&M Susp. 48" dia. Perf. Basket, St. St., Fume tight
1—Fletcher Susp. 40" dia. Imperf. Basket, Steel
1—Tolhurst Susp. 26" dia. Imperf. Basket, Steel
1—Bird 36" x 50" Solid Bowl, Steel
1—Bird 24" Horiz. Steel
1—Sharples 16P Pressuretite, St. St. UNUSED
6—DeLaval Nos. 74-11; 94-01; 600, LA-11

CONDENSERS - EXCHANGERS

10—St. St., Shell & Tube—to 800 sq. ft.
4—St. St. Coil type—40 & 55 sq. ft.
8—Steel, Shell & Tube—785, 446, 335 sq. ft.

DRYERS

1—Bowen 5' dia. Stainless Steel Spray Dyer
1—Stokes 3' dia. x 15' long Jacketed Rotary Vacuum Dryer
4—Double Drum Dryers: 42" x 120"; 24" x 60"; 22" x 38"
4—Rotary Hot Air Dryers or Kilns: 10'6" dia. x 105' L, 5' x 30', 4'6" x 40', 3' x24'
3—Rotary Furnace Tubes 24" D x 8'6" L —Chrome nickle Alloy
1—Hardinge XC-2 Ruggles Coles Rotary Steam Tube Dryer, 4' D x 30' L

EVAPORATORS—STILLS

1—Goslin-Birmingham 6775 sq. ft. Quadruple Effect, Vertical long copper tubes.
1—Conkey 1900 sq. ft. Triple Effect, Vertical long Herculoy tubes
1—Buflovak 588 sq. ft. Double Effect, all stainless steel
2—5' dia. Nickle Clad Evaporators with nickle tube bundles
1—Stainless Steel, 145 sq. ft. coil, 500 gal.
1—Stokes 150 gal. St. St. Jacketed Vacuum Still
2—Aluminum Bubble Cap Columns 36" dia. x 45 plate
3—Stainless Steel Packed Columns: 8" dia. x 26' H; 14" dia. x 25'; 23" x 80"
2—Stainless Steel Cascade Columns 5' dia. x 50' high

KETTLES

4—St. St. closed—to 1300 gal.
35—St. St. open top—to 550 gal.
5—Aluminum, closed, 35 to 250 gal.
7—Copper, open top, 80 & 100 gal.
2—Horiz. Steel, Vacuum or Pressure Cookers, Agitated, 5000 gal. & 8500 gal.

FILTERS

3—Sweetland Fiters: #12 (72 lvs.); #5 (20 lvs.); #2 (18 lvs.)
2—Oliver 5'3" dia. x 8' F Continuous Panel Type Filters, gas tight hoods and repulpers—UNUSED
1—Swenson 8' x 8' Rotary Vacuum Filter, Precoat type. Acid proof construction
5—Cast Iron Filter Presses, 30" x 30" open delivery, 28, 35, and 50 chambers
4—Filter Presses, closed delivery, 12" to 36"
1—Niagara #110-20 St. St. Pressure Filter, 110 sq. ft.

MILLS

1—Patt. Fdy "DJ" Unlined Jacketed Steel Ball Mill, 6' dia. x 8' long—UNUSED
2—Pebble Mills 6' D x 8' L
1—Al. Ch. 6' D x 16' L Steel Lined Contin. Ball Mill
3—4'6" D x 12' L contin. Pebble Mills
1—Hardinge 6' D x 22" L Conical Ball Mill, Steel Liner
1—Charlotte #50 Colloid Mill, 75 HP
1—Penna Ring Type Granulator, Trojan K3-24, 40 HP
2—Fitz. Mills "F" and "D-6"
4—Hammer Mills: Gruendler 36 x 24; Jay Bee 75 HP; Williams 14" x 14"; Williams size A, St. St. and Aluminum
1—Sturtevant 8 x 10 Jaw Crusher
3—Attrition Mills, 30", 24" & 16"

MIXERS—BLENDERS

4—Ribbon Mixers, 336 cu. ft. work. cap.
2—W & P Sigma Blade Double Arm Jacketed Mixers, 100 gal. work. cap.
2—Patt. Kelly St. St. Twin Shell Blenders, 5 & 10 cu. ft. work. cap.
7—Side Entering Stainless Steel Mixers, 10 HP, 15 HP & 25 HP

JUST PURCHASED

4—Readco Heavy Duty Double Arm Sigma Blade Jacketed Mixers 50 gal. work. cap. 30 HP Expl. Pr. Motor. Built 1951-53

3—Bartlett-Snow 6' dia. x 3' deep Jacketed Stainless Steel Mixing Kettles

TANKS

12—Aluminum, 3000 gal., 5 compart.
10—Aluminum, 500 gal., 80# WP.
1—Monel, 450 gal., coils
1—St. St., T304, ⅛" 10,500 gal. Horiz.—UNUSED
1—St. Clad, T304, ⅜", 6500 gal. Vert.
1—St. St. T316, 5/16", 4000 gal. Hor.
1—St. Clad T304, ⅜", 2000 gal., Vert., Jktd. VACUUM
10—St. St. Pressure Tanks—to 4000 gal.
20—St. St. Storage Tanks—to 1000 gal.

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Baker Perkins, Day Readco Heavy Duty, 2 to 160 gals., Double Arm Jacketed Mixers with Sigma or Fish Tail Blades.
Gemco 56 cu. ft. Double Cone Blender.
J. H. Day 50 gal. Imperial S. S. Jacketed Double Arm Mixer.
Day, Robinson, Bailey, 15 to 10,000 lbs., Dry Powder Mixers.

LABELERS

Resina LC, Capem, Elgin Cappers.
Burt Wraparound Labeler, to gal.
Pony M, MX, ML, World, Ermold, Pneumatic Semi and Automatic Labelers.

FILLERS

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S. & S. G1, G2, G6, HG88 Fillers.
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Mikro 2TH, 1SH and Bantam Pulverizers: Schutz O'Neill Mills.
Charlotte #3 Monel Colloid Mill.
Eppenbach V9 Aloxite Colloid Mill.
Rotex, Day, Robinson, Tyler Hum-mer, Great Western, Gayco, Raymond Sifters.

MISCELLANEOUS

Podbelniak 6080 S. S. Solvent Extractor.
Oliver, Sweetland #2, Sparkler, Sperry, Shriver, Alsop Filters.

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3 Chicago Pumps #VPM-5657 1000 GPM 30' TDH 6" suction x 4" discharge, vertical pedestal non-clog ejector with semisteel pump casing, pedestal and impeller with bronze water seal rings and stuffing box. Louis-Allis motor 10 hp, 220/440 v, 3 hp, 60 cy, 1150 rpm. New

3 Chicago Pumps #VPM-5656 500 GPM 30' TDH 5" suction and 4" discharge. Louis-Allis motor 7½ hp, 220/440 v, 3 hp, 1150 rpm, class 1, group D, explosion proof motor. New

1 Polar Still 50 GPH, 1 Tapered tantalum condenser, 1 Pfaudler 200 gallon tilting kettle.

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Powder mixers 50 to 5000 pounds.
Charlotte Colloid Mills, M3 & M50.
5 Spout SS Paste Filler, Automatic.
Pfaudler 10 gal. jkt. glass lined reactor, agitated.
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S. S. Tanks 50 to 10,000 gal. agitation avail.
Boilers 2 h.p. to 1000 h.p. Oil or Gas Fired.
Mikro Pulverizer 4-TH with extra screens.
Lehman 5-roll Mill 12" x 36" water cooled.
Tolhurst 48" Centrifuge.
Laughlin Continuous Filter.
Link Belt Shaker 4' x 8'.
Proctor and Schwartz 84 tray dryer, and 5, 40 trays.
Portable Electric Mixers 1/3 to 3-h.p.
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See Additional Listings on Page 497

DRYERS

1—Vulcan 8'x125' Rotary Kiln.
2—Cummer 5'x40', 5'x30' Rotary.
1—Vulcan 4½'x50' Rotary.
1—Link Belt 6'4"x24' steel Roto-Louvre, Dryer Heresite coated.
1—Link Belt 3'10"x12' steel Roto-Louvre Dryer.
1—Devine #27 double door Vacuum Shelf, 17—59"x78" shelves.
1—Stokes Vacuum Shelf Dryer #138-H-10 44'x40" shelves.
2—Struthers Wells 5'x15' nickel clad Rotary Vacuum.
1—Devine 5'x10' steel Rotating Vacuum.
2—Stokes 30"x8', 3'x15' Rotary Vacuum.
4—Buflovak Double Drum 42"x120", 32"x120", 36"x84", 32"x72".
2—Buflovak 6' and 3' dia. Crystallizers.

FILTERS

3—Oliver Monel 8'x10', 3'x2' Rotary.
1—Feinc 5'x3' Monel Rotary Vac String.
2—Sweetland #12—72, 36 leaves.
2—Sweetland #3 all S/S.
3—Sweetland #3, #5, #7.
1—Niagara 110 sq. ft. S/S.
3—Shriver 36" P&F 42 chambers.
4—Shriver 30" P&F 30 chambers.
8—Sperry 24" P&F 16 chambers.
2—Sperry Aluminum 30" and 24".
1—Sperry 36" P&F, heresite.
12—Filter Press Skeletons, all sizes.

PULVERIZERS—CRUSHERS

1—Devine 5'x10' steel, jacketed Mill.
4—Hardinge Mills 4½'x16", 6'x22", 8'x36", 10'x48".
4—Patterson 6'x8', 5'x6', 3'x4' brick-lined Pebble Mills.
1—Patterson 6'x8' porcelain (Berylite) Pebble Mill, 50 HP. NEW.
2—National 6"x12" Mills.
3—Gayco Air Separators 12', 8', 18".
3—Mikro Pulverizers #4TH, #2.

CENTRIFUGALS

1—AT&M 42" Suspended 347 S/S.
1—Bird 40" Suspended, rubber.
3—Tolhurst 40", 32" Suspended, steel.
1—AT&M 36" rubber covered.
1—Fletcher 30" Suspended, steel.
1—Tolhurst 26" Suspended, steel.
1—Tolhurst 26" Suspended, rubber.
2—Sharples PN Super-D-Canters, S/S.
2—Bird 18"x28" Continuous 310 S/S.
2—Sharples C-27, C-20 S/S Super-D-Hydrators.
2—Sharples #16P Monel and S/S. Super Centrifuges.

SPECIALS

30—S/S CONDENSERS 100, 200, 400, 600, 715 sq. ft. 1" TUBES 150#PSI.
1—2500 gal. 316 S/S jacketed, agitated Reactor 5' x 15'.
1—Link Belt 2'7" x 10' Roto-Louvre Dryer 316 S/S with drives, motors, heaters, controls and instruments.
1—Swenson 4' x 2' nickel Rotary Vac Filter.
1—7' x 25'6", 347 S/S Tower 800'-10" to 18", 347 S/S piping, valves and fittings.
250—304 and 316 S/S Valves ½" to 4".
8—Buflovak 7' x 14' closed, jacketed steel Kettles, 50 psi with 10 HP Turbo Mixers 4000 gal. cap.

SCREENS

4—#82 Rotex double deck 40"x120".
1—Patterson single deck 40"x84" S/S.
1—#23 Rotex three deck 20"x80".
1—Tyler Hummer 4'x7'.

MIXERS

10—Day "Cincinnatus" double arm Sigma Blade, 660, 250, 150, 100 and 50 gals.
2—Baker Perkins 100, 50 gal. Sigma Blades, jacketed.
5—Sprout Waldron S/S. jacketed Powder Mixers, 67, 27 and 10 cu. ft.
1—Struther Wells 6'x9' S/S. jacketed.
2—Patterson 6' and 5' Steel Conical.
2—Baker Perkins 2 gal. S/S.
1—Robinson 4000# steel powder.
6—Rodgers 400 to 3000# powder.
3—Simpson Intensive Mixers #0.
8—NEW Portable Agitators ¼ to 5 HP.
4—Day, Ross 8 and 50 gallon. Pony.

TOWERS—REACTORS—CONDENSERS & TANKS

1—2800 gal. Tank 5'x18', 316 S/S.
1—Buflovak 800 gal. 347 S/S. clad, jacketed, agitated Reactor.
5—Towers: 7'x25'6, 347 S/S., 6'x63', 6'x58' chrome lined, 42"x49', 3'x53'.
4—Foster-Wheeler Karbate Heat Exchangers 188 sq. ft.
12—Heat Exchangers 50-2400 sq. ft. Admiralty & S/S.
5—Buflovak Condensers 20 to 90 sq. ft.
4—8000 gal. Horizontal Aluminum Tanks.

MISCELLANEOUS

10—Nash Vacuum Pumps TS12, H7, H6, L5, L3 MD571, #4, #2.
3—Stokes Vacuum Pumps 10 to 50 cfm.
14—Olivite, Duriron S/S Centrifugal Pumps 1" to 6".
10—Centrifugal Pumps 60 gpm to 2000 gpm, motor driven.
11—Stokes DDS2 and "R" Tablet Machines.

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4—Sperry 18" S/S filter presses
7—Pfaudler 200-500 gallon jacketed glass lined reactors
6—80 gallon S/S 347 autoclaves, 500# internal pressure
20—Sperry 30" iron plate and frame open delivery filter presses
1—Ross 9" x 24" high speed 3 roll mill
1—Unused Haveg 750 gallon tank
20—S/S and karbate condensers, 4-1500 sq ft
1—International S/S 25 cu ft conical blender
1—Baker Perkins 500 gallon jacketed dispersion bladed mixer
8—S/S Tyler Niagara 2' x 8' and 3' x 8' screens
1—Hersey monel 3' x 24' rotary dryer
5—Baird, Ruggles Coles and Louisville 4' x 30' to 6' x 35' rotary & tubular dryers
6—Patterson 4' x 4' chrome manganese jacketed ball mills
2—Patterson 3' x 4' porcelain lined pebble mills
1—Unused Alloy Fabricator S/S type 316 jacketed reactor
1—S/S Sparkler model 18D8 jacketed filter
1—30" copper bubble cap column

2—Tolhurst and Bird 40" steel suspended type centrifuges
1—36" cast iron filter press
1—7500# heavy duty double spiral dry powder mixer
1—Stokes model T-5 tablet press
1—Colton model 5½-T tablet press
1—National Erie 8½" strainer
1—Buflovak 24" x 36" double drum atmospheric dryer
1—Buflovak 24" x 48" double drum vacuum dryer
4—2½-15-40 gallon Pony mixers
1—Buflovak 24" x 36" double drum vacuum dryer
1—Buflovak 24" x 48" double drum atmospheric dryer
4—8-15-40 gallon Pony mixers
6—Rotex sifters 20" x 48" up to 40" x 84"
8—Double arm jacketed and unjacketed mixers, 2½ gallons to 150 gallons
4—700 gallon steel mixing tanks, 2 HP, x proof
1—Simpson #2 style B mixer
1—Ross dry pan mixer, 92"
2—300 gallon S/S jacketed and agitated processing kettle*

Sample of a Million Dollar Inventory

Send Us Your Inquiries

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52 9th Street HYacinth 9-7200 Brooklyn 15, N. Y.

NEW AND GOOD-AS-NEW EQUIPMENT

1—Stainless Tank #430 Chrome, vert. 7'x10' deep.
20—Jacketed Kettles—Stainless, Copper, Aluminum.
1—Day Mixer, steam jacketed, 50 gal. Sigma Blade.
1—Copper Evaporator, steam jacketed 9'1"x3'9"
60—New Pressure Cookers, 18"x18" & 24"x28"
150—Pumps—steam and electric.
1—New Glass Nash Centrifugal Pump, 160 gpm.
1—Buflovak Jacketed Impregnating Tank 42"x52"
1—4x8 Sturtevant Jaw Crusher
1—Abbe Ball Mill, 36"x42" Buhrstone lined.
#316 Stainless Steel Tanks, new 100, 200 & 360 gal.
1—Nash Air Compressor, Type AL-623.
1—Manton Gaulin Stainless Homogenizer. 125 gph.
1—I&R Vacuum Pump, 5 H.P., 60'.
4—Heat Exchangers, 12" dia. 11' lg., 43 steel tubes.
1—Stokes Single Punch Tablet Machine.
1—Kennedy-Van Saun Rotary Dryer, 4'x40'.
Davenport Rotary Steam Tube Dryer. 6'x36'.
2—Stainless Steel Steam Jacketed Readco Mixers.
1—#316 Stainless Reactor. 265 gals. cap., jacketed.
Abbe Pebble & Tube Mill, 5'x22'—Buhrstone Lined.
1—Patterson Ball Mill, procelain lined, 17"x27"
1—Patterson Ball Mill. 42x36, jacketed.
3—Dopp Kettles with agitators 600 gal. cap.
45—Steel Tanks from 100 to 100,000 gals.
2—Large Steam Jacketed Horizontal Mixers.
Robinson Pulverizer #20, with 2 motors 10 HP each.
Robinson Ribbon Type Mixer. 30"x10'—like new.
4—Horizontal Retorts 200# w.p., A.S.M.E., from 12" to 24" dia., 4' to 12' long.
2—Crystallizers—10' long.
3—3,000 gal. Jacketed Kettles with Turbo Agitators.
1—#10 Day 300 gal. Jacketed Sigma Blade Mixer.
1—Sparkler Stainless Filter Model 18-S-23.
1—Sparkler Stainless Filter Model 33-S-9.
6—Blackburn-Smith Jacketed Filters, 20 to 160 gpm.
1—Single Deck Vibrating Screen, 3'x6'.
1—Jeffrey Vibrating Conveyor, 15' long.
4—Hoffman Steam Jacketed Filters.
1—Meade Mill #2 with 7½ H.P. Motor.

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BUCKET ELEVATORS (4½ x 5½) 16' c/c (enclosed) w/motor drive
ROTARY KILNS/DRYERS—12" x 20', 40" x 21', 6' x 40'
AUTOCLAVES—One ga. S/S 1000 psi, 54" x 6' 60 Psi (New)
FEEDERS—Syntron F-44 (selenium rectifier) Mecco 42" disc. Link Belt 18" x 13' apron (New)
SCREENS—3 x 5, 4 x 5 Tyler Hummer-single/double, Cedar Rapids 4' x 10' double
CRUSHERS ROLL—24 x 18, 30 x 16, 32 x 12, 42 x 16, single roll Link Belt 24 x 30, McLanahan 24 x 36
PEBBLE MILLS—24 x 36 porcelain lined w/feeder, 4 x 5 (345 gal) 6 x 4 (660 gal) porcelain lined
HARDINGE MILLS—2' x 8", 6' x 22", 7 x 22", 4' x 8'
HAMMER MILLS—Williams #3—14 x 19, Jeffrey Flextooth 24 x 30, Style B 42 x 24 "Miracle"
CRUSHERS-JAW—11 x 26 Champion, 24 x 13 Farrel
MIXERS—Sigma blade, 200 gal, one stainless, one monel jacketed, vacuum
VACUUM PUMPS—MD 623, MD 673, 1253, H-7

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IN STOCK

CENTRIFUGES

Sharples Super Centrifuge.
Sharples C20, SS, Super-D-Hydrator.
Sharples C27, SS, Super-D-Hydrator.
Sharples PN14, SS, Super-D-Canter.

TOWERS

SS 18-8 Scrubber, 12"x15'.
SS 347 lined, Scrubber, 5'x18'.
6'x29' 21 trays, Stainless.
5'x24' 24 trays, Everdur.
7'x54' 20 trays, 150 PSI.
6'6"x40' 16 trays, 80 PSI.
3'x44' 18 trays, 300 PSI.
Karbate #22, packed, 19"x12' NEW.
4'x59' 23 trays, 160 PSI.
7'6"x41'7" Reactor, 160 PSI.
4'6"x40' 13 trays, 180 PSI.
2'x47' 20 trays, 200 PSI.
2'x47' 20 trays, 375 PSI.
3'x49' 28 trays, 425 PSI.
2'x37' 16 trays, 250 PSI.
5'x36' Scrubber, 240 PSI.

BOILERS

3—Kewanee Firebox Boilers, 304 HP, 125 PSI WP, Series 500, Model 590, ASME & Natl. Board stamped, New 1942.

MIXERS

100 gal. Readco, jktd. dbl. sigma blades.
170 gal. Ajax dbl. arm, power pump.
1050 gal. Paddle dbl. shaft heavy duty.
3900 gal. hor. jktd. 75 PSI paddle agitator.
29 cu. ft. Patterson Conical Blender.
67-27-10 cu. ft. SS Sprout Waldron Powder.
550 cu. ft. SS. jktd. rotating oscillating.

FILTERS

Oliver, 8'x10', Steel.
Feinc, 8'x12', string discharge.
Sweetland #12.

DRYERS

Roto-Louvre 705-20 SS heating coils comp.
Roto-Louvre 604-24 complete w/furnace.
Roto-Louvre 502-20 comp. w/furnace.
Roto-Louvre 310-12 heating coils, comp.
Rotary Vac. 5'x15' nickel clad.
Rotary Vac. 30"x8', Stokes 59AB.
Rotary 26"x8' oil fired with feeder.
Rotary 4'x27' oil fired, motor drive.
Rotary 5'x67' 6" lifters.
Rotary SS, 4'x30' complete.
Rotary Kiln 8'x125'x¾" firing hood.
Rotary Kiln 10'x200'x¾" oil & gas burners, comb. chamber, dust collecting system.
SS Spray, 10'x36', gas fired.

MILLS

Raymond #1 Automatic.
10'x48" Hardinge Ball Mill.
Raymond #40 Imp, Stainless.
5'x8' Kennedy Type M, w/disc feeder.
6'x8' Abbe & Patterson

HEAT EXCHANGERS

Steel Tubes, 94 to 550 sq. ft. (5).
Adm. Tubes, 140 to 440 sq. ft. (7).

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HOT OIL TRANSFER
CENTRIFUGAL

MISCELLANEOUS

PUMP—6000 GPM Peerless Deep Well 80' head NEW.
EXTRUDER—Stainless Steel Screw 2½".
CENT. SEPARATORS—8', 5', 18".
GYRO SIFTER—72 sq. ft. 2-screen Robinson 28A.
BAG PACKER—Neuman, 50 to 100# bags.
CHURN—Baker Perkins 700 gal. cap.
BUCKET ELEVATORS—10—20' to 75'.

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300# Working Pressure, 500 gal. jacketed plus heating coil, cost $15,000. Quick Sale $3,500, perfect condition.

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FROM A UTOCLAVE TO Z AREMBA Evaporator

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AUTOCLAVES

1 Gal. Steel Autoclave 800 PSI; gas Fired; agitated ¾ HP XPL.
Struthers Wells Vulcanizer; 5'x20'; 150 PSI-ASME; qu. opening door.
Smith Stainless Lined Pressure Tanks; 10'x30'; 20,000 Gal.; 135 PSI.
Hor. Steel Autoclave; 66"x14'7"; with tracks; door each end.
Hor. Steel Pressure Tank; 1200 gal.; 5'x8'; dished heads; 50 PSI.
Many others available; send us your inquiry with approximate specifications.

BLENDERS

NEW Steel and Stainless Steel Ribbon Mixers from 400 lb. to 10,000 lb.
Porter Type 316 Stainless Mixer; 30"x36"x57"; center discharge.
Lancaster Mix Mullers, complete with accessories; several sizes.
Stainless Tumbling Mixer; 5'x5' with 3 Stand & 3 HP motor.
Sprout Waldron Stainless Continuous Cylindrical Ribbon Mixer; 28"x12'.
W&P Type Double Arm Heavy Duty Jacketed Mixer; 100 gal. & 200 gal.

CENTRIFUGALS

Baker Perkins Termeer Centrifuge in Type 316 SS; Model S12; 7½ HP motor.
Bird Continuous Centrifuge; 18"x28" with solid conical bowl.
Bird 48" Rubber Cov. Suspended Type Centrifuge with plow and fume housing.
Tolhurst Overdriven Rubber covered Centrifuge; 48"; perforate basket.
DeLaval Industrial Centrifugals; Model AA-OO with 5 HP XPL motors.

DRYERS-EVAPORATORS

Bagley & Sewell Double Drum Dryer, 28"x60"; other up to 42"x120".
Stokes Rotary Jacketed Dryers; 18"x8" and 34"x10' (Vacuum).
Devine and Stokes VacShelf Dryers; wide range of sizes available.
Louisville Rotary Steam Tube Dryers; sizes up to 54"x40"; complete.
Inconel Double Effect Evaporator; 850 sq. ft. and 430 sq. ft. Complete.
Struthers Wells S.S. Batch Evaporator, 630 sq. ft. Stainless Tubes 2" diameter.

FILTERS & FILTER PRESSES

Shriver & Sperry Pl. & Fr. Presses in Iron, Wood, Alum. Nickel, etc.
Sperry 36" Alum. 33 chamber Press; 4 eye with hydraulic closing.
Oliver Sweetland Filters from No. 2 to No. 12; wide choice.
Bird Young Rotary Vacuum Filter, 4'x4'; with Stainless Screens.
Hor. Stainless Rot. Vac. Filter; 7' Diameter with cone drive.

GRINDERS & MILLS

Mikro Pulverizers up to No. 4.
Williams Hammer Mills; in sizes up to 42"x48".
Fitzpatrick Stainless Comminutators.
Abee, Patterson and International Pebble Mills up to 8'x8' with 50 HP.
Raymond SS Imp Mill with 50 HP motor.
Bauer Double Runner 24" Attrition Mill.
Hardinge Conical Ball Mill; 10'x48".

HEAT EXCHANGERS

Whitlock SS Heat Exchanger; 250 sq. ft.; 2 pass-tube side.
Stainless Heat Exchanger or Condenser; 185 sq. ft.; 300 Tubes.
Vertical Stainless Condenser; 220 sq. ft.; 231 Tubes.
Horizontal 2 Pass Floating Hd. Heat Exchanger; 500 sq. ft.
Ross Gas Fired Indirect Heater, 5,000 CFM; complete controls, etc.

KETTLES-TANKS

Brand NEW SS Jacketed Kettles in stock; up to 500 gal.
Stainless Clad 80 gal. Kettles; jacketed for 40#.
Pfaudler Glass Lined Jacketed Kettles; 100 gal. to 1,000 gal.
Stainless Oval Milk Truck Type Tanks up to 3500 gal. capacity.
Stainless Hor. Tanks; 1000 gal. and 2000 gal. with agitators.
NEW Stainless Tanks, all sizes.

REACTORS

Struthers Wells Stainless Vac. Pans; 5'x12'8" with Calandria 630 sq. ft.
Pfaudler SS Jacketed & Agit. Reactors; 30 gal.; 40 gal. and 50 gal.
Lancaster SS Lined Rotary Jktd; 50"x17'4"; 300 PSI internal.
Monel Reactor; 782 Gal.; 1'x5'; Jacketed and agitated.
Dopp 650 Gal. Cast Iron; Jacketed Agitated; 80"x67".

STERILIZERS

SPECIAL PURCHASE JUST IN
Jacketed late type Sterilizers by American, Bramhall-Deane, Wilmot Castle with accessories and non-corrosive contacts; Sizes 24"x36"x60"; 30"x42"x84"; 30"x48"x84"; 36"x42"x84"; 48"x42"x96". Some NEW; others equal to new.

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Agitators, portable: ¼ to 5 hp.
Centrifugals: Fletcher 12" copper, 17" stain. steel, 20" lithcoated.
Tolhurst 26" copper, 18" st. steel.
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Clarifiers: De Laval 84-51, SVK5R, 94-21.
Collectors, dust: Bag type 5" dia. x 2½' to 5' long.
Condensers: stainless steel and copper, various sizes.
Conveyor: Stevedore Jr. Booster 16' long, 16" wide.
Dryers: Devine 2 x 4' vac. drum st. steel type 316.
Stokes vac. 20 shelf 40 x 44".
Devine vacuum 20 shelf.
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Davenport 3½ x 18' rotary, st. steel.
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Ruggles Coles XA 4½ x 26' rotary.
Huhn Steam Tube.
Double drum atmospheric to 120".
Louisville, Davenport Steam Tube.
Direct Heat 6' x 50'.
Evaporators: Swenson triple effect 350 sq. ft., single effect 350 sq. ft.
Majonnier st. steel, 392 sq. ft.
Rogers Special 6' stain. steel.
Exchanger, heat: Walker Wallace st. steel, plate type, 200 GPH.
Feeders: Syntron F-22, 10 x 36" trough.
Filters: Oliver 2½ x 1', Denver 1 x 3'.
Sparkler, Alsop, Lomax, Industrial.
Oliver 3' horizontal.
Filter Presses: Sperry, Shriver 6" to 36", recessed and plate and frame types.
Kettles: Stainless steel 20 to 150 gal., with and without agitators.
Devine 1500 gal. jacketed, agitated.
Mills: Pebble, Abbe 32 x 36" porc. lined.
Ball: Hardinge 5' x 36" buhr. lined.
Attrition: 30", two 40 hp. mootrs.
Mikro: 1SH, 2DH, 2 TH.
Hammer: Jeffrey 30 x 24" type A.
Hammer: Williams size BX type AK, 60 hp.
Raymond: 0000 IMP, 16" screen mill.
Raymond laboratory Screen Mil.
3-roll: Day 12 x 32", Ross 12 x 30".
Mixers: Double and single arm sigma blade.
Dry Powder: 1½ to 77 cu. ft.
Dry Powder: Robinson copper body, 60 cu. ft. and 27 cu. ft.
Pony: Day 40 gal., O&T 20 gal.
Press: Davenport continuous Dewatering type 3A, contact parts phosphur bronze screen plates #20 Durimet, 5 hp. drive.
Pumps: Centrifugal, rotary, gear, vacuum. In various sizes and metals.
Refrigeration: Freon 7½ and 10 hp.
Screens: Rotex 20 x 48" and 40 x 84".
Roball 40 x 120" stainless steel.
Selectro 4 x 10', Abbe Blutergess #1.
Sterilizers: Climax 20 x 36' jacketed.
Still: water, Precision copper 100 GPH.
Tablet Machines: rotary Stokes RB1, Colton #3 and 3RP.
Single punch Stokes model E and F.
Tanks: Stain. steel to 1200 gal. cap.
Stain. steel rectangular 4 x 4 x 11'.
Glass lined to 500 gal. cap.

Send us your inquiries and list of idle equipment.

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STOP SHOPPING AROUND

"Consolidated" Sells It ! !

2—8'x125' Rotary Kilns.
3—6'6"x50' D. H. Rot. Dryers, 5/8".
1—#2 Simpson Mixer, motor drive.
2—54"x70" and 1—40"x60" Bird Continuous Centrifugals, S/S Solid bowls.
4—S/S Merco C-30 Centrifugal Separators, ea. with 100 HP TEFC motors & controls.
2—S/S Hersey Rotary Dryers, 5x26' and 6'x23'.
1—#502-16 Link Belt S/S Roto-Louvre Dryer.
1—3'x50' Bonnot D. H. Rotary Dryers & Coolers.
3—6'6"x50' D. H. Rot. Dryers.
3—Unused #12 Sweetland Filters, 48 bronze Monel covered lvs. 3" cc.
1—50 gal. Stainless 347, Calandria Still, Agitated, with Condenser.
1—50 gal. Stainless 347, Agitated Tank, Motor Driven.
9—Sperry 18"x18 iron recessed Filter Presses, 18 chambers.
3—450 gal. S.S. Steam Jktd. Kettles.
1—Buflovak 48"x40" Drum Flaker, chrome plated, S/S ends.
1—Oliver Rotary Acid Filter, 6'x6'.
4—Mojonnier, S.S. Vac. Pans, 3', 5', 6'.
3—6'x50' L'ville Rot. Tube Dryers.
1—Day size 30 Imperial Jacketed 75 gal., Sigma Blades.
1—2TH, Mikro Pulverizer.
4—Buflovak Atmo. Dbl. Drum Dryers 24"x36", 32"x90", 42"x120".
3—Anco 4'x9' Chilling Rolls.
5—Horiz. Ribbon Dry Mixers, 4000 lb., 1500 lb., 500 lb.

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FITZPATRICK MODEL D HAMMERMILL
LOUISVILLE 6 x 30 STEAM TUBE DRYER
BUFFALO VAK 32 x 120" DOUBLE DRUM DRYER
B&P SIZE 15 dbl ARM MIXER UNIDOR
NEW S/S DBL RIBBON MIXERS 200# to 800# in stock
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ROBINSON 1500# S/S RIBBON MIXER
LIGHTNIN 3 HP PORT AGIT new
PATTERSON 4 x 5 BUHRSTONE PEBBLE MILLS
BUFLOVAK DOUBLE DRUM DRYER 32"x52"
MIKRO 3TH PULVERIZER
SPERRY 12" P&F NICKEL FILTER PRESS
100 S/S KETTLES from 2¼ to 125 Gal
S/S OR PLAIN STEEL TANKS IN STOCK

WE BUY ONE ITEM TO COMPLETE PLANT
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Lubricated Plug Cocks

4—3" Nordco type 316 #1725MA4. Hard coated plug. R. F.
5—3" Nordco type 316 #1625MA4. Hard coated plug. R. F.
7—1½" Hyper 18-8-9 series 600 MA4. Coated plug. R. J.
2—4" Hyper-steel #2345ME3 series 900 R. J. (Merchrome coated plug and body)
All or part @ list less 60%

7—1" Walworth Monel series 300 #M1736 screwed.
4—6" Walworth Monel series 300 #M1761F R. J.
All or part @ list less 60%

5—3" Walworth Nickel 225# W. O. G. #AN1736F
All or part @ list less 60%

9—3" Walworth Bronze #B1730F 3 way 3 port flanged.
2—2" Nordco Bronze #615 flanged.
2—2" Nordco Bronze #614 screwed.
1—1" Nordco Bronze #4321 screwed.
All or part @ list less 65%.

8—4" Nordco series 150 #1945 R. J.
3—8" Nordco series 150 #1985 R. F.
1—8" Nordco series 300 #4285 R. F.
1—12" Nordco series 300 #4289 R. F.
2—4" Nordco series 400 #2145 R. J.
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All the above are new and unused and had been stored in unprotected areas. New condition, guaranteed. FOB, Linden.

THE HENZE VALVE CO.
4 McCandless Street **Linden, N. J.**

For Sale — For Sale

1—Eppenbach Stainless Steel Homo Mixer complete with ½ HP Explosion-Proof Motor.
2 Premier 6" Colloid Mills, Motor Driven.
1—10" Premier Colloid Mill.
2—Motor Driven Belt Conveyors.
5—Pony Mixers, 5, 15 and 40 gal.
High Speed Roller Mills 9"x24" to 16"x40".
1—J. H. Day 40-Gallon Pony Mixer.
1—Eppenbach Coloid Mill, Model QV-8-1.

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BIRD CONT. CENTRIFUGE—36" x 50", S.S. 304
Blenders—Dry Powder—400, 600, 1000, 2000 and 3000#.
CONDENSERS, 8—all monel, 50 sq. ft. Shell and tube.
DRYER, Buffalo, double drum, 32" dia. x 90". Reconditioned. Complete with vari drive & motor.
NICKEL CLAD KETTLE, Jktd. Agit. 750 Gal. ASME.
HEAT EXCHANGERS—500 sq. ft., Carpenter 20 S.S., 240—1" x 8" tubes.
MIXERS DOUGH—50 gal. to 200 gal. Steel & S. S. Jacketed, sigma blades.
ROTEX SIFTER 40" x 84" 3 HP Motor.
TABLET PRESS, Stokes RB1, Complete.
We Buy Surplus Equipment and Complete Plants

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1—Link-Belt Roto-Louvre Stainless Steel Type 316 Dryer Complete.

1—Bowen Stainless Steel Laboratory Spray Dryer.

2—5'6" x 42" Rotary Dryers ½" Shell.

1—Swenson Walker Stainless Steel Jacketed Crystallizers, 20 ft. long.

5—Baker Perkins 1000 gallon Jacketed Double Arm Mixers.

THE GELB GIRL NOVEMBER 1955

AUTOCLAVES—KETTLES TANKS

3—Mixing Equipment 3000 gallon Steel Jacketed Turbo Agitated Kettles.
1—Mixing Equipment 600 gallon Steel Jacketed Turbo Agitated Kettle.
1—Stainless Steel 250 gallon Jacketed Kettle.
1—Nooter steel jacketed vacuum kettle, 750 gallons.
1—Plate Fabricators 6,000 gallon Jacketed Kettle.
12—Koven Stainless Steel Jacketed Vacuum Kettles, 380 Gals. Cap. Each.
1—Stainless Steel, 4000 gal Tank.

CENTRIFUGALS

1—Bird Stainless Steel 48" suspended type Centrifuge with perforated basket, plow and explosion proof motor.
2—Sharples S.S. super pressurite centrifuges, Model 16.
2—Sharples Type 316 Stainless Steel Centrifuge, Model D2.
1—DeLaval Type 316 Stainless Steel Multi-Matic Centrifuge.
1—A. T. & M. Stainless Steel Susp. Centrifuges, 48" Imperforated Basket.

DRYERS—KILNS

1—Rotary Dryer 2' x 14' Complete.
5—Buflovak Single Door Vacuum Shelf Dryers 5, 7, 10 and 20 shelves.
2—3' x 17' Rotary Dryers Complete.
1—Vulcan 7' x 120' Rotary Kiln Complete.
1—Proctor & Schwartz Hot Air Dryer, 16 shelves.
1—Devine laboratory vacuum shelf dryer with 3 S.S. shelves (New).
1—3' x 12' Stainless Steel Rotary Vacuum dryer.
1—Steel and Alloy 3' x 15' Heresite-lined-Rotary Vacuum Dryer.
1—Stokes Rotary Vacuum Dryer, 30" x 8'.
1—Buflovak 32' x 90" Double Drum Dryer.

CONDENSERS, HEAT EXCHANGERS & COLUMNS

3—A. O. Smith Stainless Steel Heat Exchangers 1500 sq. ft. each.
5—Stainless Steel Condensers, 15, 20, 55 and 90 sq. ft.
12—Struthers Wells S.S. heat exchangers, 650 sq. ft. each.
1—Hatfield Stainless Steel Bubble Cap Column, 6' x 16'6", 7 trays.

FILTERS

1—Shriver, 36", eye open delivery, washing type Filter Press with 35 chambers and Simplex hydraulic closing device.
1—Shriver C.I. Plate and Frame, 2 eye, open delivery Filter Press 42" x 42", 54 chambers.
1—Oliver Rubber-lined Pressure Filter, 3'x6'.
2—Sparkler Filters, Model 18-S-4 and 18-S-8.
1—Sperry 36" Plate and Frame Open delivery Filter Press, 40 ch.

1—Filtration Engineers, Type 304 Stainless Steel, Rotary Vacuum Filter, String Discharge, Size 3' x 3'. (New)

5—Cyclotherm C-90 Package Boilers, 125 PSI, Capacity 3000 Lbs. Steam per hour.

1—Baker Perkins 100 gallon Double Arm Sigma Blade Jacketed Mixer, Hydraulic Tilt.

1—Sperry 3-eye, closed delivery, cast iron. Plate and frame Filter Press, 9 ch., 30" x 30".
1—Sperry Wooden Plate and Frame Filter Press, 12" x 12", 15 chambers.

MIXERS

1—Day Cincinnatus S.S. 200 gal. sigma blade mixer.
1—Banbury Mixer, midget size with 2 HP motor.
1—Day Stainless Steel Double Arm Jacketed Sigma Blade Mixer, 50 gal.
4—Simpson Intensive Mixers #0.

MISCELLANEOUS

1—Stokes Model DDS-2 Tablet Press, 23 Punch with 7½ H.P. Drive.
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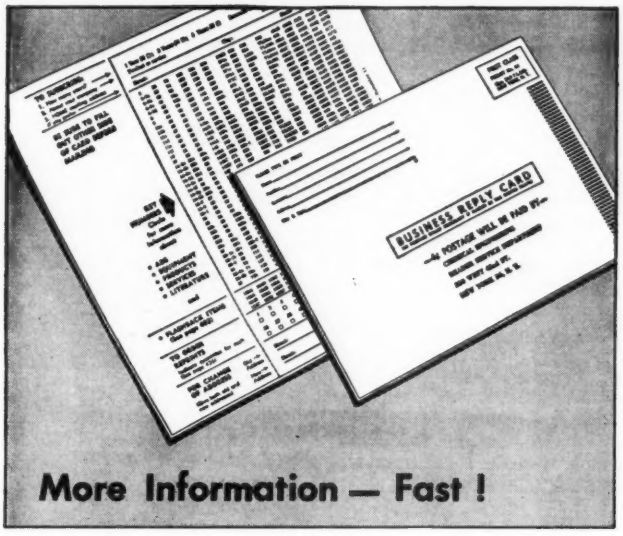

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What the Code Means . . .

Each item has a code that's the key to its location in this issue. The numerals show the page where you'll find the item mentioned. The letters L (left), R (right), T (top) B (bottom) locate ad positions on the page; the letters a, b, c and A, B, C identify items on a page or in an ad.

For More Information . . .

You can get more information on any product listed in Reader Service postcard in this directory by using the side the back cover. Simply circle the item's code number on the postcard, then mail to us. Answers will come to you direct from the companies manufacturing the products.

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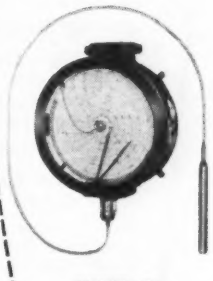

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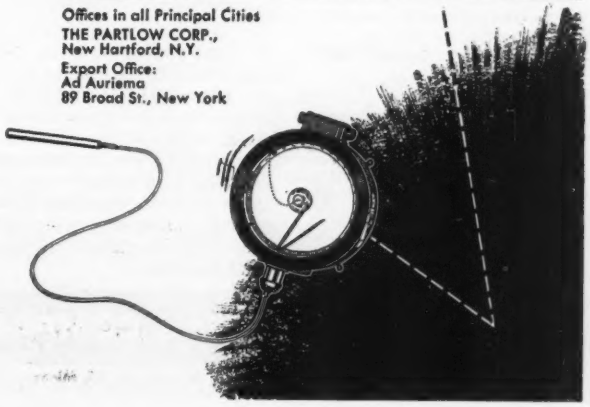

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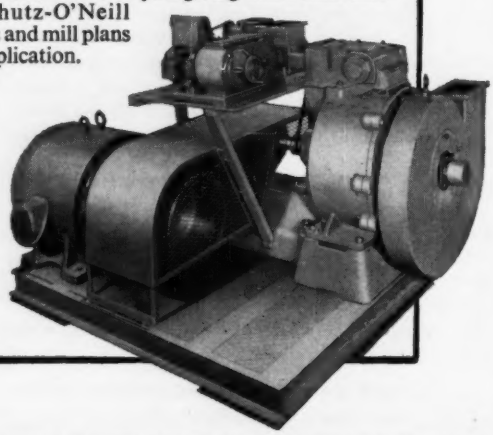

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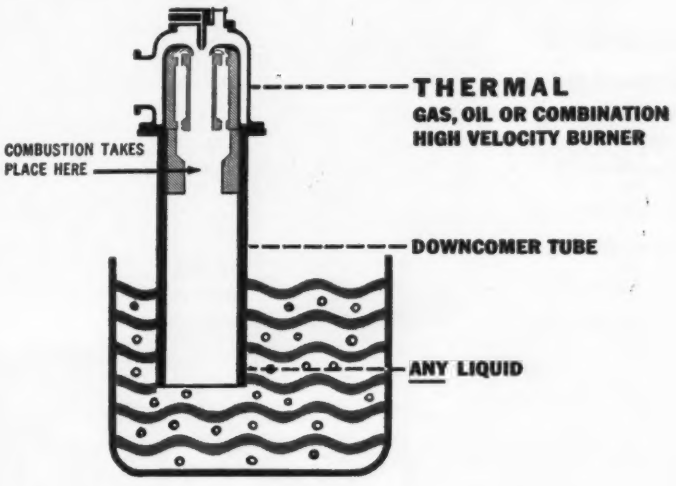

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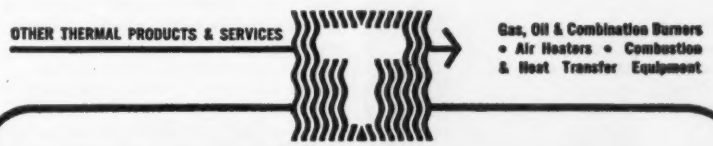

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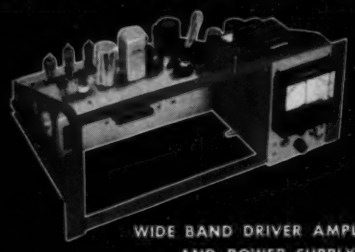
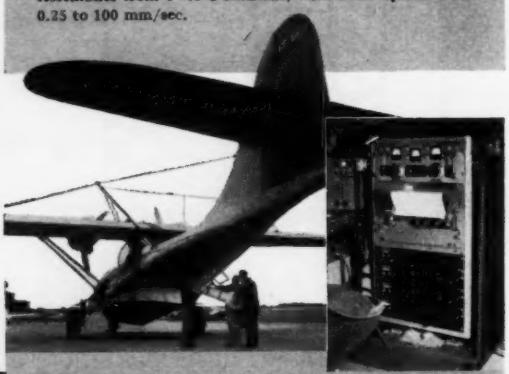


WIDE BAND DRIVER AMPLIFIER AND POWER SUPPLY

THIS amplifier (Model 150-300/700) is designed for use with low power galvanometer elements (output ±25 ma full scale into 100 ohm load), an oscilloscope and/or a panel meter, individually or simultaneously. Eleven plug-in type, interchangeable Preamplifiers are available for use with it, and include: AC-DC, Carrier, DC Coupling, Servo-Monitor, Log-Audio, Low Level, Input Network, AC Wattmeter, Frequency Deviation, Stabilized DC, and an RMS Volt/Ammeter.

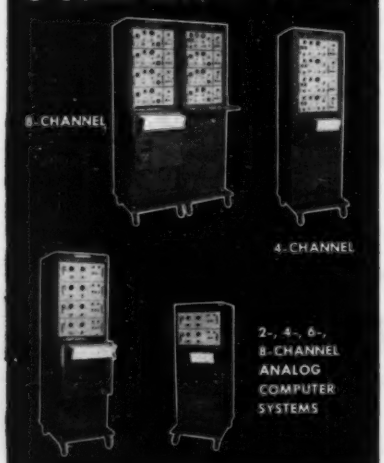
Other available separate components include Recorder Assemblies from 1- to 8-channels, with chart speeds from 0.25 to 100 mm/sec.



A "component" application

FOUR Model 67-300 DC Amplifiers and a Model 154-100 four-channel Recorder Assembly are integrated with other equipment aboard a "flying geophysical laboratory" by PSC Applied Research, Ltd. of Toronto to record data from dual frequency detector magnetic survey equipment and a radiation detector, plus elevation variations during flight. The simultaneous recording of all four provides valuable reference data when interpretations are being made.

● COMPLETE SYSTEMS



A Sanborn "150" system starts with a choice of an 8-, 6-, 4-, 2- or 1-channel basic assembly, to which the user adds any combination of plug-in type Preamplifiers to meet the numerous and changing recording requirements. Special 8-, 6-, 4-, and 2-channel systems are available for recording the output of analog computers, or other applications involving 1 volt/cm sensitivity. Added to this application versatility and operating flexibility of Sanborn systems are other advantages, such as inkless recording in true rectangular coordinates ... high torque (200,000 dyne cm) galvonometer ... time and code marking ... numerous chart speeds.

Let Sanborn engineers help you solve your recording problems. Write for complete specifications and performance data on any Sanborn component or system.

SANBORN COMPANY
INDUSTRIAL DIVISION
CAMBRIDGE 39, MASSACHUSETTS

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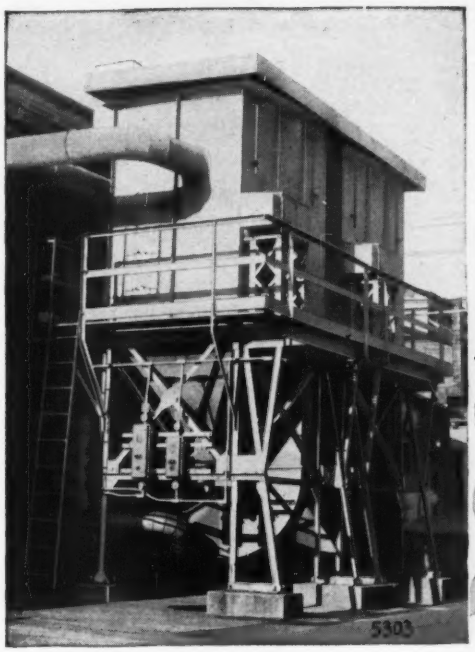

Sly Dust Filter at the plant of Merck & Co., Inc., Rahway, New Jersey.

SLY KEEPS VITAMIN PLANT DUST-FREE

Packaging Unit showing exhaust duct connected to Sly Dust Filter.

Merck & Co., Inc. uses Sly Dust Filters to maintain quality of product and manufacturing efficiency in the processing of vitamin mixtures.

The final ground powders are blended, milled, sifted and subdivided. Dust tends to escape from each operation. By the use of proper hooding of dust sources the dust is drawn into Sly Dust Collector. About 1.10 to 1.25 percent of each mixture is recovered and reused.

During the past ten years Merck has installed 21 Sly Dust Filters —a fine tribute from a fine company.

No matter what you make or process—if there's dust, you need Sly.

MERCK

Manufacturers of: Dust Control Systems, Blast Cleaning Equipment, Tumbling Mills, Industrial Ovens.

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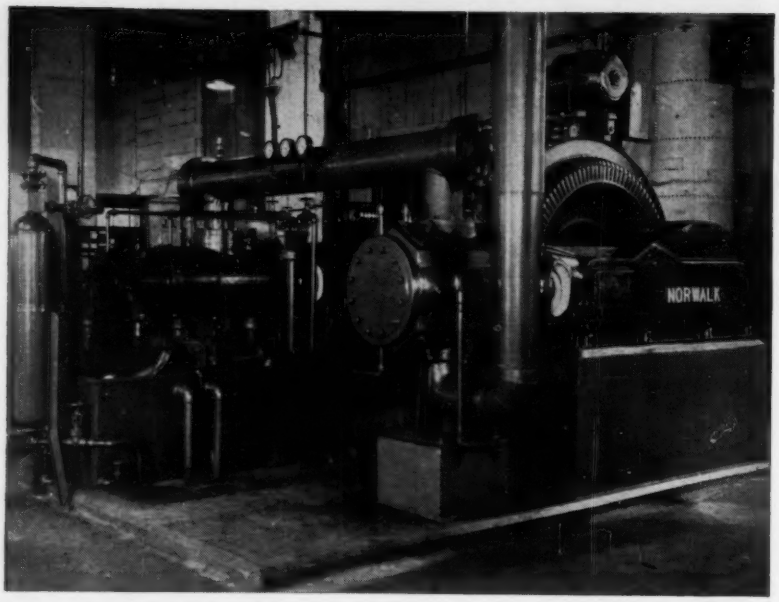
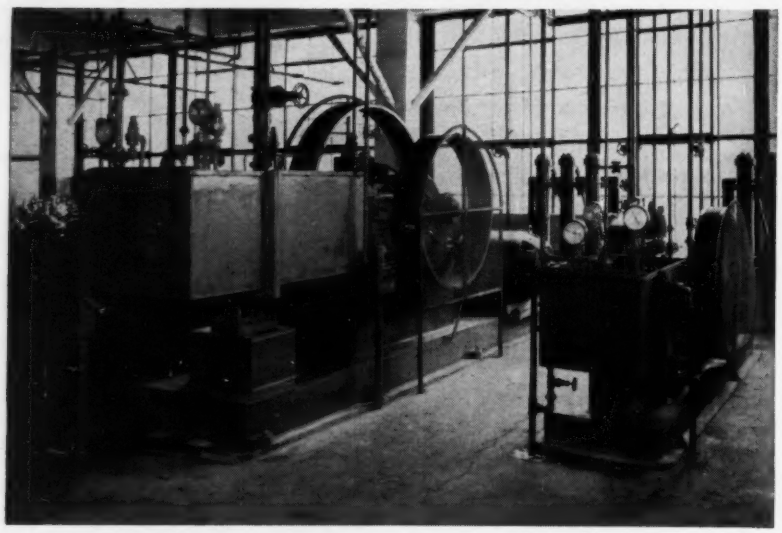


Three stage duplex air compressor for 1000 pounds pressure, located in a large industrial plant



Acetylene compressors in a large industrial plant

Reversible ring plate valves, force feed lubrication, sealing type piston rings, generous intercooler coils are some of the features (common to all Norwalk compressors) that make for efficiency and long-term economy. Descriptive catalog mailed on request.

NORWALK COMPANY, INC.

SOUTH NORWALK, CONNECTICUT

makers of high pressure compressors for 91 years — 1864-1955

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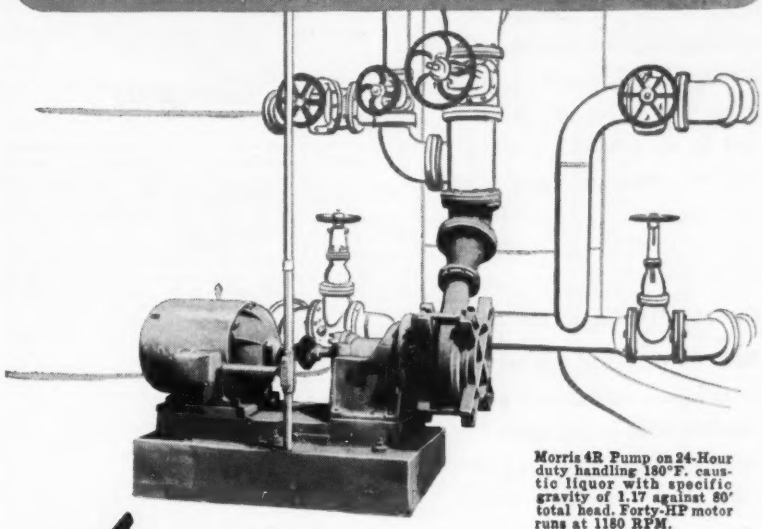
For Continuous 24-Hour Pumping

of solid or chemical mixtures



Morris 4R Pump on 24-Hour duty handling 180°F. caustic liquor with specific gravity of 1.17 against 80' total head. Forty-HP motor runs at 1180 RPM.

Morris Type R Slurry Pumps

Ordinary harsh abrasives wear out your pump. Corrosive action of acids eats away its utility. Time-consuming maintenance and repairs cut down your production. Here's why the Morris Type R helps avoid these problems . . .

1.—Simple design. No internal studs and bolts—no troublesome internal joints and fits.

2.—Easily dismantled. Impeller and shaft sleeve reached by simply removing 4 *external* bolts.

3.—Abrasive resistant. Casing furnished in large variety of wear-resistant materials, including glass or porcelain.

4.—Large hydraulic passages. Permit low velocities to minimize wear and frequency of renewals.

5.—Drive-side suction. Stuffing box troubles practically eliminated under conditions of high suction pressure, high vaccum and high suction lift.

Let our engineers help you select the right pump for your job. Or write for Bulletin No. 181.

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Baldwinsville, N. Y.
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MORRIS *Centrifugal Pumps*

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Want to build up your files and keep them up-to-date? This comprehensive guide to available literature will help you do just that. They're yours—free—for the asking.

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This is a comprehensive listing of the latest literature you can now get from manufacturers on chemicals, equipment and services in all fields of interest to chemical engineers. It lists new publications just released, in addition to technical literature mentioned in the advertisements in this issue. The latter are identified by an asterisk (*) along side the company name.

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You can get—and get fast—more information on any publication listed in this guide by using the Reader Service postcard inside the back cover. Simply circle the item's code number on the postcard, fill in your name and address, then mail to us. Ask for as many as you need. Answers come to you direct from the companies putting out the literature.

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Chemicals

Acetyl Peroxide.....Company makes available upon request a literature reference covering their line of acetyl peroxide. Includes a detailed outline of the physical and chemical properties. Bulletin No. 5.
516A Buffalo Electro-Chem. Co.

Acid Esters, Itaconic.....9 p. describes 2 itaconic acid esters—dimethyl itaconate & di-n-butyl itaconate. Includes properties, reactions, molecular structures, toxicity, etc. Request Data Sheet No. 501.
516B Chas. Pfizer & Co.

Acid, Peracetic.....New technical booklet describes efficient hydrogen peroxide-resin technique. Request "Hydrogen Peroxide-Resin Technique for the Preparation of Peracetic Acid." Bulletin No. P 63-355.
441b *E. I. du Pont de Nemours.

Acid, Peracetic.....Company announces the availability of a valuable article reprint entitled, "Application of Peracetic Acid Germicidal Washes to Mold Control of Tomatoes." Request Bulletin No. 15A.
516C Buffalo Electro-Chem. Co.

Alcohol, Polyvinyl.....Elvano produces tough, grease-resistant films. Films have high tensile strength, impermeability to gases, and resistance to tearing or puncturing. Request literature and information.
441c *E. I. du Pont de Nemours.

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99 *Norton Co.

Aluminum Fluoride, Powder, Technical.....Makes available an informative Data Sheet which offers pertinent details concerning physical and chemical properties, suggested uses, containers, etc. No. DA-32521.
516D Baker & Adamson.

Biphenyl, Chlorinated.....Reports received from installations show that Monsanto Aroclor 1248 . . . a chlorinated biphenyl . . . is proving to be a superior heat-transfer medium. Technical Bulletin O-P-130.
32-3a *Monsanto Chem. Co.

Bleaching, Textile.....''Fluorescent Agents in Hydrogen Peroxide Bleaching of Knit Goods" discusses practical application of optical bleaching agents to peroxide bleaching of knit goods. Bulletin 53.
516E Buffalo Electro-Chem. Co.

Bleaching, Textile.....Makes available article reprint, "Knit-Goods Bleaching Range" . . . a description of high capacity continuous range for tension-free bleaching of knit goods. Request Bulletin No. 61.
516F Buffalo Electro-Chem. Co.

Boron Trifluoride, Ether Complex, Technical.....Presents informative Data Sheet which gives pertinent details concerning physical and chemical properties, suggested uses, containers, etc. No. DA-34711.
516G Baker & Adamson.

Carbon, Activated.....Selection of proper grades & types for industrial processes, characteristics of Adsorbite activated carbon & application of activated carbon processes, covered in Bulletin No. 11.
516H Barnebey-Cheney Co.

Carbon Dioxide.....There's practically no end to the important jobs that CO_2 combined with Liquid Carbonic savvy—is doing. For examples of CO_2's amazingly diversified talents, request "Applications Unlimited."
R365 *Liquid Carbonic Corp.

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442 *Carborundum Co.

Catalysts.....You benefit with Girdler catalysts: custom design matches your needs; technical service helps you save; quality control assures uniformity; etc. For complete information, request Bulletin G-260.
395 *Girdler Co.

Cellulose Acetate Butyrate.....44 p. "workbook" contains latest data on formulation & use of new & interesting film-forming material, "Half-Second Butyrate"—its properties, modifications & applications.
516I Eastman Chem. Products.

Chemicals, Gas-Treating.....Maximize purity of your gas stream & minimize corrosion problems by using: monoethanolamine, diethanolamine, diethylene glycol, triethylene glycol. Request data and samples.
277a *Nitrogen Div., AC&D.

Chemicals, Industrial.....24 p. booklet alphabetically lists the numerous chemicals available. Tells the story about Harshaw's growth since its beginning in 1897. Includes pictures of plants, warehouses, etc.
79 *Harshaw Chem. Co.

Chemicals, Oxygen, Active.....Company makes available upon request a literature reference covering line of active oxygen chemicals. Becco peroxygen compounds are listed and described. Bulletin No. 1.
516J Buffalo Electro-Chem. Co.

Choromethanes.....Valuable data on diverse uses & physical & chemical properties of chloromethanes—methylene chloride, methyl chloride, chloroform, carbon tetrachloride—in new, comprehensive 28 p. reference.
147 *Solvay Process Div.

Chromium Nitrate, Crystal, Purified.....Makes available an informative Data Sheet which gives pertinent details concerning physical and chemical properties, suggested uses, containers, etc. No. DA-35801.
516K Baker & Adamson.

Colloids.....Profusely illustrated brochure, "Colloids Out of the Sea," describes some of the interesting uses for SeaKem Colloids . . . in ice cream, puddings, chocolate milk, toothpaste, etc. 8 p.
516L Seaplant Chem. Corp.

Defoamers.....A 2½ pound brick of convenient, easy-to-handle Hercules Defoamer 4 can make as much as 40 gallons of highly effective foam control solution. Makes available a valuable testing sample.
66b *Hercules Powder Co.

Defoamers, Silicone.....Defoamers have proved their efficiency and versatility in countless applications. Offers a new booklet with complete information on Dow Corning Antifoam agents plus a product sample.
R533 *Dow Corning Corp.

Dimers, Alkylketene.....Illustrated Bulletin describes Aquapel—tradename for a family of alkylketene dimers. Gives properties, application and describes properties of paper sized with Aquapel.
517A Hercules Powder Co.

Di(exo)decyl Phthalate.....Covers general characteristics & properties of "Flexol" Plasticizer 10-10—a distilled phthalate ester which is a primary plasticizer for vinyl chloride resins. Ref. F-8948-A.
517B Carbide & Carbon Chem.

Elastomers, Synthetic.....Vyram is a remarkable synthetic elastomer which resists swelling action of both synthetic & petroleum-base hydraulic fluids & lubricants. Details in Technical Bulletin ODB-55-21.
32-3b *Monsanto Chem. Co.

Emulsions & Detergents.....Illustrated, 96 p. features valuable sections on: emulsification; surface active chemicals; oil and solvent emulsions; "soluble" oils and solvents; detergents; etc. Book F-4168D.
517C Carbide & Carbon Chem.

Epoxidation-Hydroxylation Reactions..... Epoxidation-hydroxylation reactions with hydrogen peroxide & peracetic acid. General review gives typical procedures & suggested applications, Bulletin No. 16.
517D Buffalo Electro-Chem Co.

Epoxidation with H_2O_2.....Literature and data on epoxidation technique for natural fats, oils and derivatives. New method increases epoxy content; lowers by-product formation; eliminates preforming peracid; etc.
12 *E. I. du Pont de Nemours.

Ferric Nitrate, Crystal, Technical..... Makes available an informative Data Sheet which gives pertinent details concerning physical and chemical properties, suggested uses, containers, etc. No. DA-37441.
517E Baker & Adamson.

Flatting Agents.....Covers Acrawax C Powdered, a fairly hard moisture resistant wax which gives additional advantages by acting as a slip agent & by improving wear & moisture resistance. Includes samples.
517F Glyco Products Co.

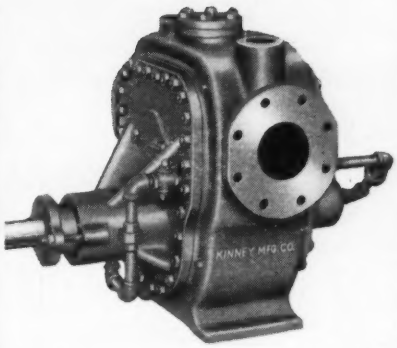
Furan.....With maleic anhydride and other dienophiles furan forms normal addition compounds leading to physiological active molecules. For detailed information about reactive compound, request literature.
441d *E. I. du Pont de Nemours.

Furfural.....16 p. devoted to physical data on QO brand, including recovery of furfural from various systems, vapor pressure graph & temperature-composition diagram of furfural-water. Bulletin 203-A.
517G Quaker Oats Co.

Glyceraine.....Offers valuable bookets including "Glycerine—Preferred for Product Conditioning," which outlines properties that make glycerine preferable in conditioning toilet goods and pharmaceuticals.
321 *Glycerine Producers' Assoc.

Gum, Cellulose.....Illustrated, 24 p. covers properties and uses of Hercules cellulose gum (CMC). Includes a comprehensive description of what CMC is, where it is used, and how it is used. Graphs and tables.
517H Hercules Powder Co.

Hexylene Glycol.....Technical information on hexylene glycol, a colorless, low-freezing glycol with unusual solvent & wetting properties. Includes physical properties & applications. Reference F-7114B.
517I Carbide & Carbon Chem.



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what size pump do you need?

CONDENSED CAPACITY DATA — MODEL SD

Size	Theoretical Displacement in U.S. Gal. per 100 R.P.M.	Maximum Pressure, Lbs. per Square In.
SD 311	1.46	100
SD 312	2.80	100
SD 373*	5.44	70
SD 424*	9.2	75
SD 533	13.7	175
SD 534*	17.8	75
SD 645*	36.	100
SD 646*	42.7	100
SD 844*	40.7	250
SD 846*	59.	150
SD 848*	76.	75
SD 866*	88.6	100
SD 868*	114.	75
SD 1076*	131.	150
SD 1078*	166.	150
SD 12810*	292.	100
SD 12812*	342.	75
SD 14912*	458.	125
SD 161016*	760.	100
SD 201016*	978.	150
SD 251318*	1808.	150

*These sizes available with steam jacketed cylinders.

Pump size selection depends upon material viscosity at pumping temperature, working pressure, and whether pumping is continuous or intermittent. But, whatever size you need, there is a Kinney SD Rotating Plunger Pump to fit the job.

The Kinney SD is a rugged, simple pump designed without valves, blades, springs, or vanes, to give you maintenance-free operation. And, due to its high volumetric efficiency, this pump is often used to meter or proportion fixed amounts of viscous materials and components. For further information, mail coupon today!

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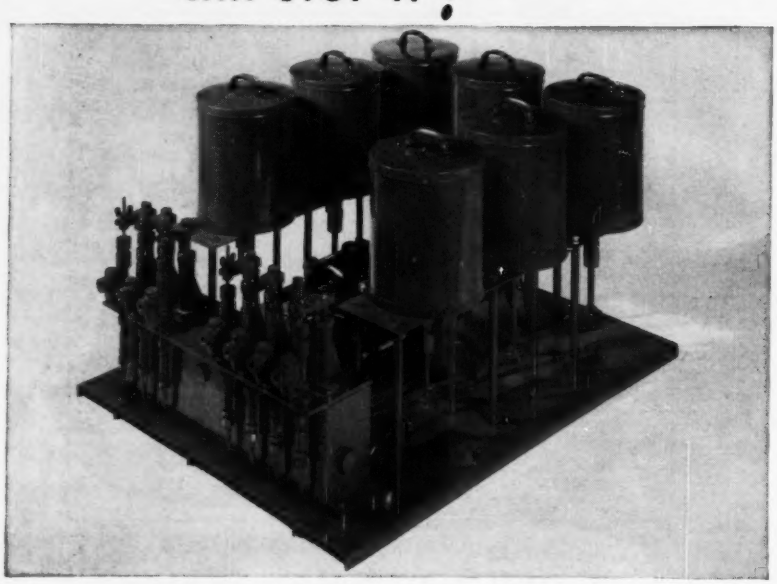
MANZEL CHEMICAL FEEDERS CAN STOP IT!



✱ In chemical processes where foaming is a problem, Manzel engineers have a record of successfully eliminating it through the use of Manzel Chemical Feeders. There are models of large and small capacity—for simultaneously feeding many different chemicals at rates from a few drops to 60 gph per feed. They are easily synchronized with any process — supremely accurate and dependable in service.

Specialists, too, in Force Feed Lubrication

Manzel Force Feed Lubricators can be depended upon to deliver exactly the right amount of lubricant, to exactly the right places, at exactly the right times. Available for operation against discharge pressures of up to 30,000 P. S. I. G.

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324 BABCOCK ST., BUFFALO 10, N. Y.

LITERATURE . . .

Hydrogen Peroxide.....“Self-Heating of Hydrogen Peroxide Storage Vessels”—a discussion of H_2O_2 storage and storage containers and recommended procedure for H_2O_2 storage. Request copy of Bulletin No. 54.
518A Buffalo Electro-Chem. Co.

Hydrogen Peroxide.....“Stability of Pure Hydrogen Peroxide” discusses effects of purity, stabilizers, acid concentration & other factors on stability of high strength hydrogen peroxide. Bulletin No. 55.
518B Buffalo Electro-Chem. Co.

Lead Nitrate, Crystal, Technical..... Makes available an informative Data Sheet which gives pertinent details concerning physical and chemical properties, suggested uses, containers, etc. No. DA-38371.
518C Baker & Adamson.

Lithium Amide.....Molecular weight—22.964; color and form—white crystalline; density—1.178 g./cc. at 17.5°C.; melting range—380-400°C.; etc. Makes available a Data Sheet providing complete information.
475a *Lithium Corp. of America.

Lithium Hyride.....Data Sheet offers information covering color and form, density, dissociation pressure, solubility, chemical behavior, aplications, availability, purity, handling and storage, etc.
475b *Lithium Corp. of America.

Lithium Metal.....Lithium has been used for many years in metallurgy as a degasifier, deoxidizer, desulfurizer and general purifying agent. Data Sheet covers chemical behavior, applications, purity, etc.
475c *Lithium Corp. of America.

Methyl Parathion.....New reference includes: product characteristics & features; registrations for use (at USDA & state levels); precautions for handling; formulation data. Technical Bulletin No. 0-55.
32-3c *Monsanto Chem. Co.

Monomers.....Makes available a reference list of monomeric compounds, giving physical properties, an up-to-date expression of current production status, & plans for future availability. Ref. No. F-8498-B.
518D Carbide & Carbon Chem.

Nitroparaffins.....As solvents, the NP's present an unusual combination of properties. Request Technical Data Sheet for details, specifications, properties, uses, solubility tables, etc. plus product samples.
149 *Commercial Solvents Corp.

Oils, Castor.....New 16 p. catalog & product guide of castor oils & chemical derivatives covers uses & suggested applications of over 90 castor oil products with their physical & chemical properties.
518E Baker Castor Oil Co.

Oxamide, Purified.....Company announces availability of an informative Data Sheet which gives pertinent details concerning physical and chemical properties, suggested uses, containers, etc. No. DA-48651.
518F Baker & Adamson.

Oxidation Reactions.....“Oxidation Reactions with Aliphatic Peracids” discusses preparation of peracid solutions & their use in various oxidation reactions of interest in organic synthesis. Bulletin 17.
518G Buffalo Electro-Chem. Co.

Persulfates.....Offers reference, “Uses of Persulfates—A Bibliography”—a selected list of literature references based on “Chemical Abstracts” & covering period from 1907 to 1950. Bulletin No. 34.
518H Buffalo Electro-Chem. Co.

Plasticizers.....Illustrated, 20 p. describes a premium monomeric plasticizer, Hercoflex 600—an ester of pentaerythritol & a saturated aliphatic acid. Physical & chemical characteristics & applications.
518I Hercules Powder Co.

*See Explanation on Page 516

Polyvinyl Materials.....Products made from Geon rigid vinyl include corrosion-proof pipe, fume ducts, tanks, trays, materials that can be machined, planed, sawed, drilled, and cemented. Offers technical information.
9 *B. F. Goodrich Chem. Co.

Potassium Acetate, N.F., Crystal, Technical.....Offers an informative Data Sheet which gives pertinent details concerning physical and chemical properties, suggested uses, containers, etc. No. DA-40821.
519A Baker & Adamson.

Potassium Persulfate.....Company announces the availability of literature describing the product line. Includes information on chemical & physical properties, uses & handling. Request Bulletin No. 11.
519B Buffalo Electro-Chem. Co.

Resins.....Folder describes advantages of using Truline Binder—a dry, pulverized, thermoplastic resin, in core & molding sands. Tells how it reduces sand cost, provides greater strength to bonded cores, etc.
519C Hercules Powder Co.

Resins, Acrylic.....Lucite acrylic resins available with a wide range of molding characteristics & properties & in a variety of transparent, translucent & opaque colors. Offers descriptive literature on request.
151a *E. I. du Pont de Nemours.

Resins, Coating.....Newly revised booklet describes Plaskon coating resins, including characteristics of the following: alkyds, ureas, melamines, silicon-alkyds, modified phenolics, maleics, and ester gums. 8 p.
519D Barrett Div.

Resins, Condensation.....A water-white sulfonamide-formaldehyde condensation resin, Santolite MHP is widely used to give polyvinyl acetate adhesives quick tack. Details in Technical Bulletin No. 0-94.
32-3e *Monsanto Chem. Co.

Resins, Ion Exchange.....Explore catalysis with Nalcite ion exchange resins for: increased yields; processing shortcuts; continuous or batch process; added safety; lower costs; etc. Technical Bulletin.
391 *National Aluminate Corp.

Resins, Nylon.....Zytel is the du Pont trade-mark for a versatile group of long-chain synthetic polymeric amides exhibiting extreme toughness & strength. Complete data on properties & applications on request.
151b *E. I. du Pont de Nemours.

Resins, Plastisol,.....An extremely fine powder with high molecular weight, created to impart excellent heat & light stability, physical toughness & chemical stability to your products. Complete product data.
257. *Firestone Plastics Co.

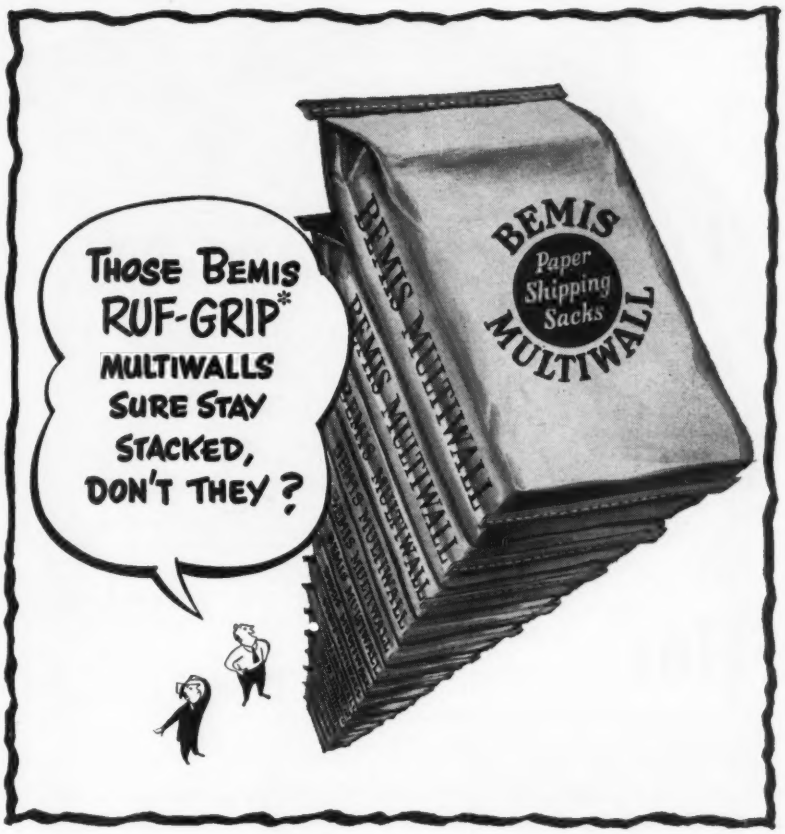
Resins, Polyethylene.....Tough, flexible Alathon polyethylene resin stands up well against abrasive slurries. Widely used in industrial pipe applications. Offers complete information on the properties and applications.
151c *E. I. du Pont de Nemours.

Resins, Tetrafluoroethylene.....Teflon tetrafluorethylene resins used extensively in process industries. Offer chemical inertness, high heat resistance, low-temperature toughness, etc. Properties & applications.
151d *E. I. du Pont de Nemours.

Silica Gel.....A superior drying agent for natural gas. For detailed information and field performance data on the use of Davison silica gel for the drying of natural gas, request Technical Bulletin No. 201.
415 *Davison Chem. Co.

Soda Ash.....West End is a pure white, free-flowing and rapidly soluble soda ash that produces a far cleaner, more uniform product. Announces the availability of product samples, prices, and technical information.
410 *West End Chem. Co.

*See Explanation on Page 516



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Filtration Engineers, Inc.

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155 ORATON STREET • NEWARK 4, N. J.

LITERATURE . . .

Soda, Caustic.....“Caustic Soda Buyer’s Guide” contains helpful facts on economics of 50% & 73% solutions; other forms of caustic soda; capacities of tank cars & other containers; useful shipping data; etc.
458e *Hooker Electrochem. Co.

Sodium Carbonate Peroxide.....Company announces the availability of literature describing the product line. Included are chemical and physical properties, uses and handling. Request Bulletin No. 6.
520A Buffalo Electro-Chem. Co.

Sodium Dispersions.....Sodium dispersions were first developed by Du Pont & are particularly useful in systems where sodium is insoluble. Request literature on sodium dispersions & how to use them to advantage.
441a *E. I. du Pont de Nemours.

Sodium Fluoborate, Crystal, Technical.....Furnishes an informative Data Sheet which gives pertinent details concerning physical and chemical properties, suggested uses, containers, etc. No. DA-42401.
520B Baker & Adamson.

Sodium Sulfhydrate.....Hooker sodium sulfhydrate dissolves rapidly, even in cold water. There’s virtually no sedimentation even after long standing. Available in 90-lb. & 350-lb. drums. Technical Data Sheet.
458b *Hooker Electrochem. Co.

Sodium Sulfide.....The clean, strong flakes dissolve right into process, even without stirring. No waiting . . . no decanting. For complete information on Hooker’s sodium sulfide, request Technical Data Sheet.
458a *Hooker Electrochem. Co.

Solvents, Odorless.....With either of Sinclair’s two types of top-quality Odorless Solvents . . . you can produce a superior odorless paint. Makes available product samples, prices and complete information.
167 *Sinclair Chem.

Specialties, Perfume.....Attractive, 4 p. Folder describes origin, development & application of “specialties.” Also includes a brief description of eight of the company’s newest items in this category.
520C Dodge & Olcott.

Thread Compounds.....Big “D” Thread Dope (90% atomized metallic lead, 10% vehicle, with wonder Silicones added for plus performance) excels wherever thread compound is needed. Request sample and Brochure.
408 *C. H. Dragert Co.

Waxes, Synthetic.....Describes Acrawax C, a synthetic wax with unusual properties making it particularly effective as an anti-corrosion sealer for porous metal coatings. Literature & samples on request.
520D Glyco Products Co.

Zinc Formate, Crystal, Purified.....Makes available an informative Data Sheet which gives pertinent details concerning physical and chemical properties, suggested uses, containers, etc. No. DA-44441.
520E Baker & Adamson.

Construction Materials

Alloys.....Hastelloy alloy D has excellent resistance to sulphuric acid in all concentrations and at temperatures up to the boiling point. Announces availability of a booklet which describes Hastelloy product line.
243 *Haynes Stellite Co.

Coating Systems, Protective.....New Ucilon coating systems give chemical engineers effective weapons against corrosion. Systems based on neoprene coatings for air dry or force dry application. Bulletin No. MC-9.
444b *United Chromium.

*See explanation on p. 516

Coatings, Protective.....Now . . . your own painter can "cold-galvanize" and steel surface with Dimetcote (100% inorganic zinc coating) . . . any place—anywhere—anytime. Request Dimetcote Technical Bulletin.
245 *Amercoat Corp.

Coatings, Protective.....For any equipment or surface that can be uniformly baked . . . Plastisol compounds offer easy, economical way to apply long-lasting vinyl coating protection. Data in Bulletin No. VP-I.
444a *United Chromium.

Fabricated Products, Polyethylene & Polyvinyl Chloride.....48 p. general catalog illustrates & describes full line of polyethylene & polyvinyl chloride fabricated products, plates, sheets, rods, tubes, etc.
521A American Agile Corp.

Fabrication, Metal.....Manufactures metal products for many industrial uses . . . from complete carbon-black plants to steel conveyor boxes. Designs, engineers and fabricates to specific needs. Full data.
524 *Boardman Co.

Fabrication, Plate.....Illustrated, 12 p. covers dozens of typical examples of plate fabrication work done by the company for chemical, refining, petrochemical, food and other process industries. Request Bulletin PF.
92 *Downingtown Iron Wks.

Fabrication, Process Equipment.....Designed and built around the use of Haveg—basic construction material that resists corrosion. Includes size and cnemical resistance charts in 64 p. illustrated Bulletin F-6.
468 *Haveg Corp.

Fabrication, Stainless Steel.....Feature the techniques of fabricating equipment with round corners for efficient service—round corners are stronger . . . easier to clean. Guide provides complete information.
388 *S. Blickman, Inc.

Insulation, Block.....Eagle-Picher PV Supertemp block insulation . . . with the new "precision-finish." A highly efficient, all-purpose insulating block that is practically dustless. Offers valuable product sample.
46 *Eagle-Picher Co.

Insulation, Cellular Glass.....Will give you the maintenance-free insulating performance you need for your piping, tanks, spheres and other industrial equipment. Request descriptive product booklets.
478 *Pittsburgh Corning Corp.

Insulation, Pipe.....Lower heat losses, lower cost with new Snap*On glass fiber pipe insulation. Available in sizes that will fit pipe from ¾" to 33" nominal diameter, inclusive. Request Technical Bulletin SO-55.
319 *Gustin-Bacon Mfg. Co.

Insulation, Pipe & Block.....New universal pipe & block insulation for all temperatures from 100° to 1600°F. Illustrated Folder shows specifications, installation details, and facts on Alltemp insulation.
467 *Philip Carey Mfg. Co.

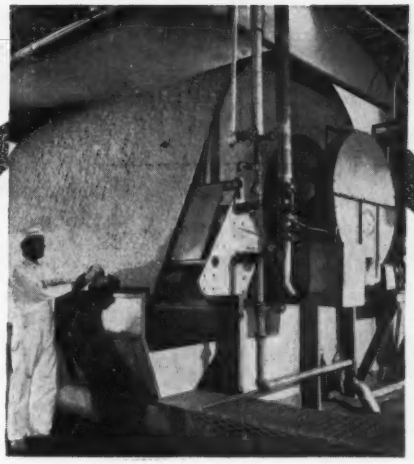
Laminates, Resin-Bonded.....Pla-Tank resin-bonded laminate products for chemical-resistant service in metal finishing & chemical process industries. Data Sheets cover tanks, pipe, ducts, hoods, stacks, etc.
R337 *Chemical Corp.

Linings, Drum.....Unichrome drum linings deliver resilient, seam-free, pore-free protection against such materials as acids, alkalies, salt solutions, alcohols, detergents, etc. Request descriptive Bulletin No. DL-2.
444c *United Chromium.

Molding Materials.....Containing 25 case histories, illustrated "Design File" serves as a convenient handbook for evaluation & use of G.E.'s rubber-phenolic molding materials. Reference No. CDC-237A.
521B General Elec. Co.

*See Explanation on Page 516

IN PECTIN EXTRACTION



One FEinc Continuous Filter Replaces Two Presses and Six Men

Looking at this clean, quiet picture, you'd never know this filtration job was formerly a hot, steamy mess, requiring six men per shift to load and unload wet, acid-laden press blankets, racks and press cars of two stop-and-go hydraulic presses.

Now it's a smooth-running, *really continuous* filtration operation, on this big FEinc String Discharge Filter. Only one operator is now required, with very little to do except watch the cake roll off hour after hour. Even the daily washup takes little time and effort.

Pectin recovery is reported to be as good as formerly. Losses due to leakage and spillage have been eliminated. The dynel cloth on this filter lasts more than a year . . . a substantial saving in the cost of filter cloth.

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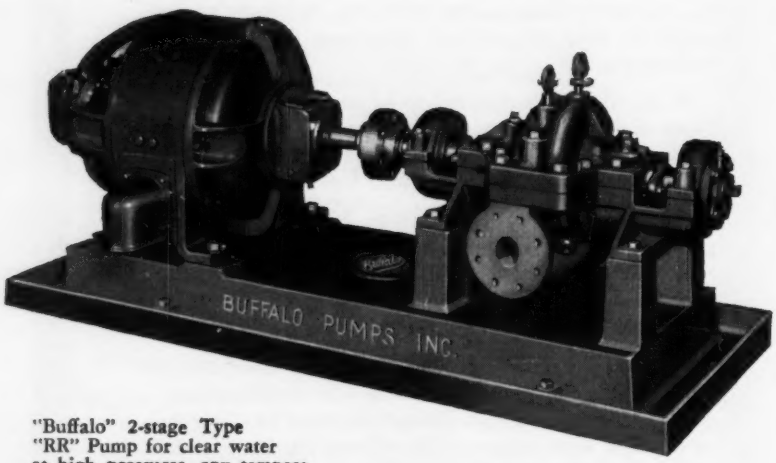
NOTE: The "Buffalo" Pumps line is complete! There's a design for almost any liquid you may handle, under a wide range of hydraulic conditions. Let us know your problem—we'll mail you literature on the right pumps!



"Buffalo" 2-stage Type "RR" Pump for clear water at high pressures, any temperatures. Widely and successfully used on boiler feed for many years. 2 and 4 stage models to deliver up to 900 gpm at heads as high as 1500'. Bulletin 980.

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LITERATURE . . .

Paints, Aluminum.....Put a protective shield on rustable metal & masonry surfaces—resist corrosion from fumes & smoke—seal against moisture & rust—reflect light & heat—etc. Descriptive literature.
97 *Reynolds Metals Co.

Sealants.....Furnishes a reference guide and chart explaining the multiple uses of special chemical sealants in a variety of industrial, manufacturing, processing, agricultural and maintenance operations.
522A Permatex Co.

Steels, Nickel Plated.....For heavy industrial use—CF&I Lectro-Clad nickel plated steel provides economical protection against product contamination & discoloration. Request new Technical Manual.
67 *Colorado Fuel & Iron Corp.

Steels, Stainless.....Makes available valuable reference, "AL Stainless Steel in Chemical Processing"—36 p. on various applications, advantages, etc. of stainless in the chemical industry. Request your copy.
522B Allegheny Ludlum Steel Corp.

Steels, Stainless.....Covers superior stainless steel sheets, strip, bars, plates, wire, forgings, etc. Data in informative 44 p. booklet, "Making the Most of Stainless Steels in the Chemical Processing Industry."
433 *Crucible Steel Co. of America

Titanium Sponge.....Resists chlorides & other corrosive chemicals as no other structural metal can. Offers general booklet on titanium plus new technical bulletin with data on corrosion-resistant properties.
335 *E. I. du Pont de Nemours.

Electrical & Mechanical

Belts, V-.....Four reels of Veelos adjustable v-belt replace up to 316 different sizes of endless belts—& take up a space of only 16 in. square. Veelos Data Book contains valuable engineering data.
41 *Manheim Mfg. & Belting Co.

Belts, V-.....Complete line of Maurey Mor-Grip fractional horsepower & heavy-duty multiple v-drive belts are described in a 3-color, 24 p. Catalog. Includes construction & applications. Catalog v-55.
522C Maurey Mfg. Corp.

Changers, Speed.....Describes operating advantages of "Vari-Pitch" speed changers. Includes arrangement diagrams, selection table showing recommended unit size for standard motors, etc. Bulletin 20B6013D.
522D Allis-Chalmers Mfg. Co.

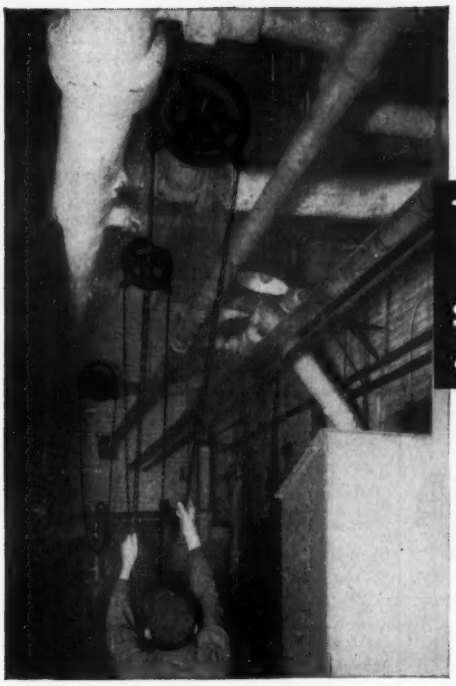
Control Devices.....Illustrated, 68 p. contains photos, wiring diagrams, book prices, dimensions on motor starters, contactors, relays, solenoids, switches, push buttons, etc. Bulletin No. GEC-1260A.
522E General Elec. Co.

Controllers, Current.....Describes the Model EB controller, showing operating features, specifications, dimensions, & illustrating typical examples of the wide range of applications. Bulletin No. EB-1.
522F Conoflow Corp.

Drives, Silent Chain.....88 p. brochure offers detailed engineering data. Covers design and application information, drive components and accessories, operational and technical data, etc. Request Book No. 2425.
295 *Link-Belt Co.

Fasteners, Stainless.....Comprehensive reference lists stainless fasteners available, including style & size data about stainless screws, bolts, nuts, washers, rivets, etc. Request copy of Bulletin No. P&A.
522G Allmetal Screw Products Co.

*See Explanation on Page 516



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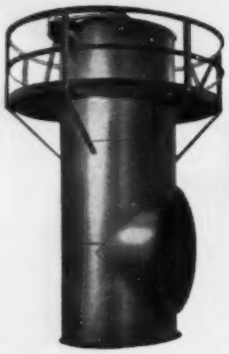
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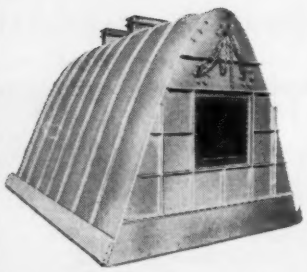
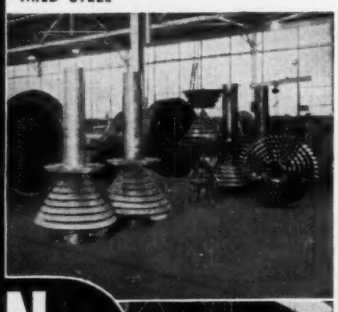
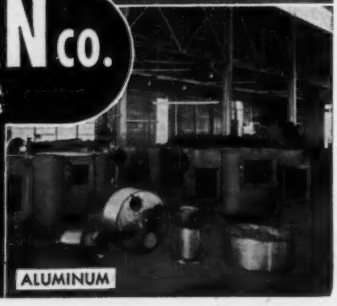

MILD STEEL

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LITERATURE . . .

Gears.....Gear Manual includes 76 p. of illustrations, diagrams, definitions, tables, charts & explanations regarding all types of gears. Also a simplified method of calculating hp ratings. Catalog G-655.
524A Philadelphia Gear Wks.

Motors.....Get both bearing features—fully enclosed and protected . . . yet easy to grease. For complete information describing maintenance—cutting design, request a copy of Bulletin No. 51B7286.
44 *Allis-Chalmers Mfg. Co.

Motors.....Describes newly designed standard & explosion-proof enclosed motors, featuring corrosion-resistant cast iron frames, improved winding insulation & heavy-duty ball bearings. Bulletin No. MU-203.
414 *Wagner Elec. Corp.

Motors, Totally-Enclosed.....Precision-engineered & precision-built to new NEMA standards—ideally suited to "air-over-motor" applications where moisture, fumes, dust, etc. are a problem. Bulletin No. CE-3304.
437 *Diehl Mfg. Co.

Motors, Varidrive.....With a U. S. Varidrive motor you can get instantly all the speeds needed for every operating condition. For an informative full color 16 p. reference, request Booklet No. 1797.
269 *U. S. Elecl. Motors.

Packings, Sheet Rubber.....Valuable pamphlet describes in detail, recommended applications, available sheet and sizes, of a new line of packing material . . . designed to cure rubber continuously. 4 p.
524B Boston Woven Hose & Rubber.

Rims, Sprocket.....Operation of overhead valves solved thru use of Babbitt adjustagle sprocket rim with chain guide. Fits any valve wheel—quickly installed—low in cost. Offers descriptive product literature.
TL523 *Babbitt Steam Specialty Co.

Seals, Balanced Pressure.....8 p. reference describes rotary type fluid seals, with complete installation and design data and some typical installations. Includes detailed diagrams and tables. Bulletin No. 7.
524C Sealol Corp.

Seals, Mechanical.....BJ makes reliable high-precision seals in material & construction combinations to answer almost any pressure, temperature & liquid requirements. Information in Bulletin No. 54-1-10,000.
421 *Byron Jackson Div.

Seals, Mechanical.....Save installation time—eliminate maintenance costs . . . with Garlock's new Unitary Mechanipak Seals for process pumps. For complete information on features, request Folder No. AD-151.
139 *Garlock Packing Co.

Seals, Mechanical, Rotary—Company announces the availability of a new 8 p. reference which shows how you get maintenance-free sealing that slashes fluid mixing cost to a new low. Illustrated Bulletin B-111.
123a *Mixing Equipment Co.

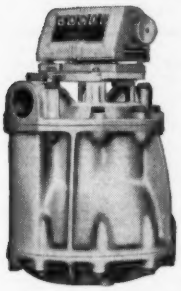
Seals, Packaged.....New addition to "John Crane" family of anti-corrosive Type 9 Seals is the answer to a simplified means of seal installation (or removal) in modern split-case pumps. Complete details.
389 *Crane Packing Co.

Tanks, Pumpless Rectifier.....G-E pumpless rectifiers are the most economical way to get d-c power in the 750-kw range and above. Company makes available complete product information in Bulletin No. GEA-5689.
302-3 *General Elec. Co.

Turbines, Mechanical Drive.....New De Laval HCB Single Stage Turbine is simple, rugged, designed for long economical life and low maintenance. Detailed reference gives vital facts and figures. Bulletin 4206.
471 *De Laval Steam Turbine Co.

*See Explanation on Page 516

Automated
liquid handling depends on meters

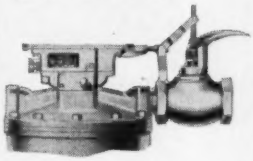


SPECIFY THE INDUSTRY-PROVED **BOWSER**

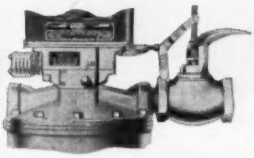
XACTO
Widest selection of models for every plant...

Choose from the world's leading, most widely used line. XACTO meters are easily adapted with choice of dials and controls for changing needs to speed liquid handling operations and provide accurate accounting.

Recording printer mounts on meter. Prints quantity dispensed or received.



Delivers predetermined quantities up to 10,000 gallons, then shuts off.



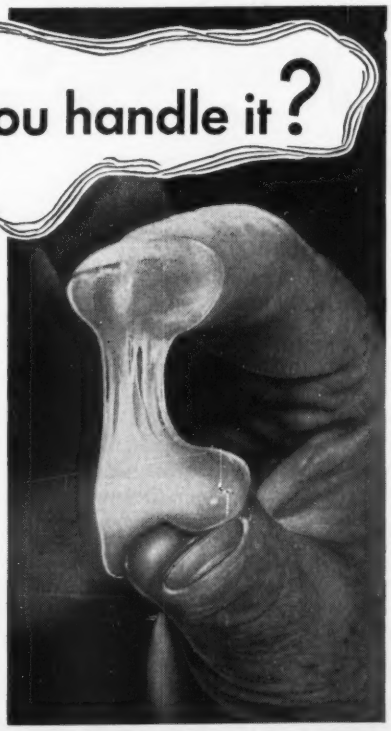
A repeating control for delivery of predetermined quantities. Automatic. With or less recording printer.

GET ALL THE DATA YOU NEED NOW ...WRITE...

BOWSER ESTABLISHED 1885

BOWSER, INC., FORT WAYNE, IND.
1375 E. CREIGHTON AVE.

how do you handle it?



PUMP IT with a VIKING

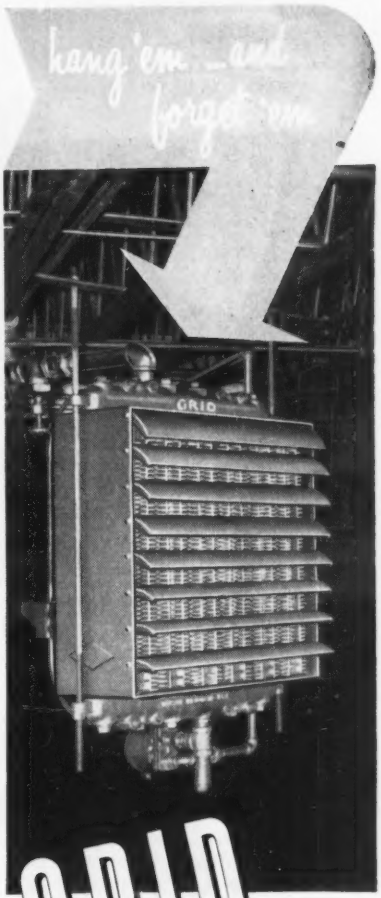
Most of the nationally known companies pump many sticky liquids with P-O-S-I-T-I-V-E VIKING ROTARY PUMPS.

The Viking "gear-within-a-gear" action and port designs allow such material to readily enter the pump. The non-slip action of the gears forces the liquid out in a steady volume.

Capacities ½ to 1050 GPM. 750 cataloged models. Thousands of special designs.

Investigate today the smooth, even flow of Vikings handling either viscous or thin liquids. To start, ask for bulletin series 558c.

VIKING PUMP COMPANY
Cedar Falls, Iowa, U.S.A. In Canada, it's "*ROTO-KING*" pumps
THE ORIGINAL "GEAR-WITHIN-A-GEAR" ROTARY PUMP



GRID UNIT HEATERS

Trouble-free heating service in
Major CHEMICAL PLANTS
since 1929

One of the reasons for this wide acceptance of GRID Unit Heaters is its cast iron construction that stands up well against corrosive fumes of HCl, Cl₂, etc., plus these other outstanding features of construction—

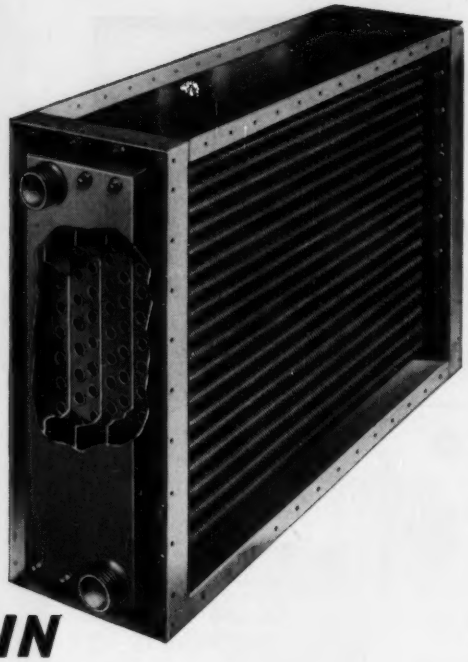
GRID'S All-Cast construction having similar metals in contact with steam prevents electrolytic corrosion.

GRID'S ability to withstand steam pressures up to 250# P.S.I.

GRID'S low outlet temperatures, proper fan sizes and motor speeds assure delivery of warm, comfortable air in ample volume, directly to the spot where it is needed. Maintenance cost conscious management men turn to GRID for relief from the continuous expense of heating failures experienced with ordinary unit heaters. GRID Unit Heaters installed in 1929 are still operating today . . . the only attention needed has been an occasional oiling of the motor. No ordinary unit heater can approach this record.

WRITE for complete catalog . . . also ask about G R I D Blast Coils that are ideal for use throughout many chemical processing industries. (Catalog BC-1049)

D. J. MURRAY MANUFACTURING CO.
Manufacturers Since 1883
WAUSAU, WISCONSIN



AEROFIN

TYPE R Removable-Header
WATER COILS

- Complete Drainability
- Easily Cleaned
- High Heat Transfer

Completely drainable and easily cleaned, Aerofin Type "R" coils are specially designed for installations where frequent mechanical cleaning of the inside of the tubes is required.

The use of 5/8" O.D. tubes permits the coil to drain completely through the water and drain connections and, in installations where sediment is a problem, the coil can be pitched in either direction. The simple removal of a single gasketed plate at each end of the coil exposes every tube, and makes thorough cleaning possible from either end.

The finned tubes are staggered in the direction of air flow, resulting in maximum heat transfer. Casings are standardized for easy installation.

Write for Bulletin No. R-50

AEROFIN CORPORATION

101 Greenway Ave., Syracuse 3, N.Y.

Aerofin is sold only by manufacturers of fan system apparatus. List on request.

LITERATURE . . .

Turbines, Solid-Wheel.....Feature reliable, trouble-free operation. Rugged construction and superior design result in savings by keeping maintenance costs down to a minimum. Full details in Bulletin No. S-116.
78 *Terry Steam Turbine Co.

Handling & Packaging

Belting, Conveyor.....Release a wall chart on the proper selection & maintenance of conveyor belting. The chart (23 in. x 33 in.) contains 12 practical maintenance tips for getting more life out of belts.
526A Hewitt-Robins.

Buckets.....Illustrated, 24 p. covers 2, 3, & 4 line Clamshell Buckets. Includes classified tables of some 60 different sizes of buckets, containing wt., dimensional & capacity data. Bulletin 2378-R.
526B Blaw-Knox Co.

Caustic Potash Handling.....New, generously illustrated brochure describes the manufacture and usage of caustic potash. Reference includes detailed procedures for unloading and precautions for handling. 18 p.
526C Columbia-Southern Chem.

Conveyors.....Handle packages, parts, units—faster—at reduced cost with gravity or power roller, belt, slat, chain, wheel or push-bar conveyors. Specifications, drawing & application data in General Catalog.
534 *Standard Conveyor Co.

Conveyors.....In any industry wherever dry bulk materials are used . . . the introduction of Airstream conveyors invariably leads to lower-cost materials handling. For full details, request 24 p. Bulletin 529.
170 *Dracco Corp.

Conveyors.....Announces release of new, illustrated 20 p. conveyor catalog. It is a facts book to be used for laying out a conveyor system using the new Lamson pre-engineered "Install-It-Yourself" units.
526D Lamson Corp.

Conveyors, Vibrating.....G-W Oscilveyor—the vibrating conveyor that puts all vibration to work . . . moves bulk materials inexpensively, quietly, rapidly. New Idea Book on engineered materials handling available.
TL488 *Gifford-Wood Co.

Cranes, Bucket.....To enable users of overhead traveling bucket cranes to obtain maximum cable life and top performance from their clamshells, Blaw-Knox releases an illustrated, 8 p. folder, Form No. 2510.
526E Blaw-Knox Co.

Detectors, Metal.....New Dings Universal Series Metal Detector will detect the presence of all magnetic metals in materials that pass through the Detector Search Coil. For details, request product literature.
543 *Dings Electronics.

Drums.....Tight head or removable head types . . . protect sensitive chemicals, oils, and food products against contamination during shipment or in storage. Request Hackney Drum and Barrel Catalog.
86 *Pressed Steel Tank Co.

Feeders, Wet Reagent.....Accurately meter minute quantities of liquid from 0 cc to 2000 cc per minute. Float valve in tank permits connection of feeder to bulk storage device. Data in Bulletin F6-B9.
361e *Denver Equipment Co.

Loading Arms.....Provides descriptive information on the new hydraulically controlled Chiksan Marine Loading Arm . . . the first basic improvement for loading and unloading of petroleum products in over 30 years.
51 *Chiksan Co.

*See Explanation on Page 516

Magnets.....Presents the all-new Dings Dynamic Perma-Plate Magnets . . . for efficient—low cost tramp iron removal. Describes the numerous features and advantages of versatile magnets in Catalog No. 1205-D.
479 *Dings Magnetic Separator Co.

Materials Handling, Bulk-Flo.....Equipment designed to reduce handling costs on wide range of materials. Features ability to feed, convey, elevate in one compact, fully enclosed assembly. 28 p. Book 2475.
13 *Link-Belt Co.

Pulleys, Magnetic.....Fully illustrated, 16 p. describes line of Electro-magnetic pulleys & pulley separators. Includes a new simplified pulley selection method & detailed specifications. Bulletin No. 303-C.
527A Stearns Magnetic

Scales.....Releases illustrated folder on various types of suspension hopper scales which are widely used for mixing, proportioning or batching of various ingredients in many industrial fields. Bulletin 82.
527B Webb Corp.

Scales, Bagging.....Depend on the E-50 to give you fast accuracies of ± 1 to ± 2 oz., or better. Bagholders, manual or air-operated, are available. For complete details, request illustrated Bulletin 3749A.
60 *Richardson Scale Co.

Scales, Bagging.....Covers improved FFFP Bagging Scale. Includes new features, such as a pneumatic gate assist & a belt feeder which permits high bagging speeds. Illustrated Product Data Sheet No. 5001.
527C Richardson Scale Co.

Slakers & Feeders.....Explains accurate lime feeding & complete slaking with Omega lime slaker & feeder. Contains installation & product photos, data on dry feeders & lime slakers, advantages, etc. Bulletin 40-E1B.
527D Omega Mach. Co.

Storage Terminals.....For the full story of how bulk liquid storage at Hess terminals can reduce your distribution or manufacturing costs, request company's new illustrated reference, "You Can Depend On Hess."
293 *Hess, Inc.

Tank Storage, Plasticizers.....**"The** Bulk Tank Storage of Plasticizers" includes: materials of construction useful in setting up bulk tank storage units, storage tanks, pipe lines, etc. Tech. Bulletin O-69.
32-3d *Monsanto Chem. Co.

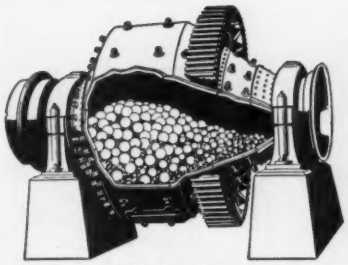
Tanks, Storage.....Describes full line of distilled water storage tanks. Covers features of tanks, available in aluminum or tinned copper & in 7 sizes, from 10 to 500 gallons. Illustrated Bulletin No. 915.
527E Precision Scientific Co.

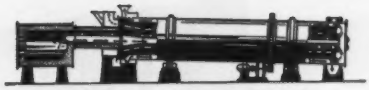
Traps, Pipeline.....Illustrated brochure on new liquid-handling magnetic pipeline traps. Gives construction information, dimensions and installation instructions for both models. Request Bulletin No. B-605.
527F Eriez Mfg. Co.

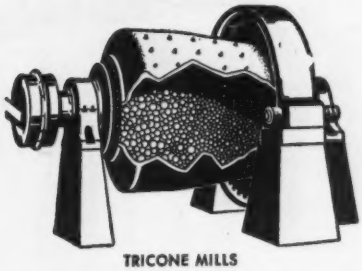
Trucks, Aluminum.....Lightness, torsionally flexible bed construction and exclusive casters are chief Magcoa/Tobey aluminum truck features described in new Folder. Includes photos and specifications.
527G Magnesium Co. of America.

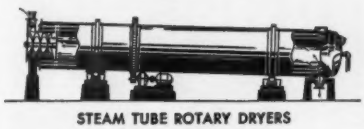
*See explanation on p. 516

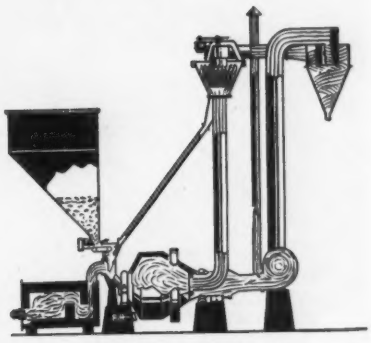
→ Want more information on any of these items? Just circle its code number on the postcard inside the back cover, then mail to us. It's that easy now.

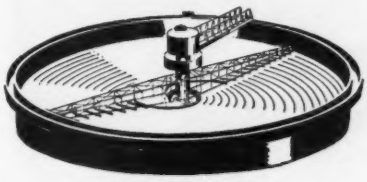

CONICAL MILLS

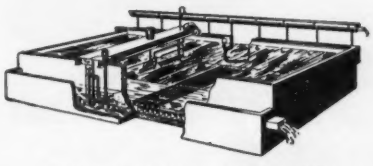

INDIRECT-HEAT ROTARY DRYERS

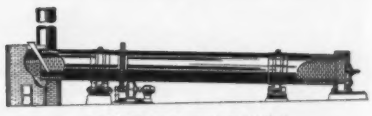

TRICONE MILLS

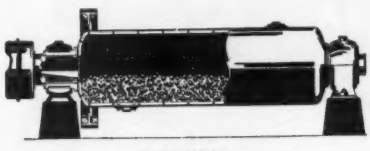

STEAM TUBE ROTARY DRYERS

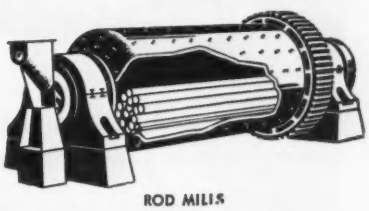

AIR CLASSIFYING SYSTEMS

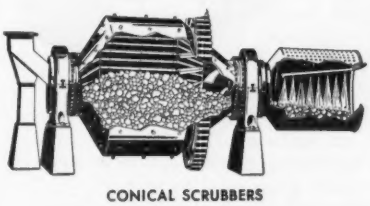

THICKENERS—CLARIFIERS

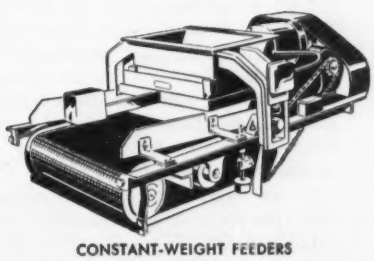

AUTOMATIC BACKWASH SAND FILTERS

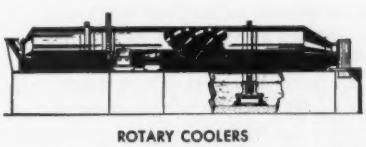

ROTARY AND SHAFT KILNS


TUBE MILLS


ROD MILLS


CONICAL SCRUBBERS


CONSTANT-WEIGHT FEEDERS


ROTARY COOLERS

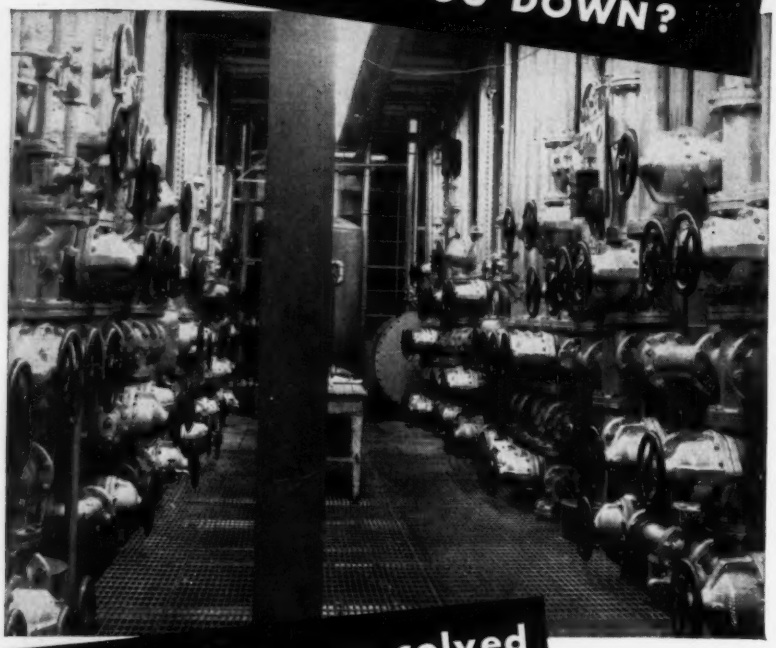
Write for general catalog 100-A-11 which describes the entire Hardinge line.

HARDINGE
COMPANY, INCORPORATED

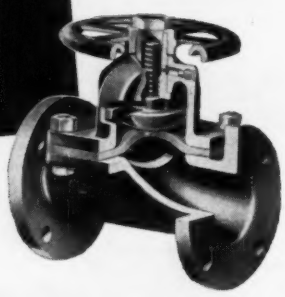
YORK, PENNSYLVANIA • 240 Arch St. • Main Office and Works

New York • Toronto • Chicago • Hibbing • Houston • Salt Lake City • San Francisco

VALVE MAINTENANCE COSTS GETTING YOU DOWN?



The problem was solved in this plant with HILLS-McCANNA diaphragm valves



IF YOU HANDLE CORROSIVE FLUIDS
THEY'LL DO THE SAME FOR YOU

The unique Saunders Patent design of Hills-McCanna Diaphragm Valves completely isolates the working parts of the valve from the flow. There is no packing to tighten or replace . . . no problem of leakage, internally or externally. You have a choice of body materials of any machinable alloy or linings of lead, glass, rubber, plastic, etc. Fifteen diaphragm materials are available including rubber, Neoprene and Teflon. There is also a wide choice of manual or remote operators. Sizes range from ⅜" through 14". May be used at pressures to 150 psi, temperatures to 350° F.

If you valve corrosive materials write today for descriptive folder. For specific recommendations send an outline of your requirements. HILLS-McCANNA CO., 2341 W. Nelson St., Chicago 18, Ill.

HILLS-McCANNA

saunders patent diaphragm valves

Also manufacturers of
Chemical Proportioning Pumps • Force-Feed Lubricators
Magnesium Alloy Sand Castings

V-11

LITERATURE . . .

Heating & Cooling

Aftercoolers & Separators.....Booklet prepared to help firms lower hidden costs of compressed air use. Includes suggestions, a check list of aftercooler effectiveness, size & capacity charts. Bulletin 711.
528A R. P. Adams Co.

Boilers, Packaged Automatic.....Offer valuable features: low-cost, space saving installation; fast steaming; instant response to load changes; quick fuel change-overs; clean, dry steam; etc. Data in Bulletin 1220.
43 *Orr & Sembower.

Coils, Water.....Aerofin Type "R" Removable-Header Water Coils offer valuable features: complete drainability; easily cleaned; high heat transfer. For complete information, request Bulletin No. R-50.
526 *Aerofin Corp.

Coolers.....Illustrated reference describes air & gas aftercoolers. Cool & remove water vapor & oil from compressed air. 125 to 7500 cfm capacity. Covers features, specifications, etc. Bulletin No. A-27.
528B Joy Mfg. Co.

Coolers, Cascade.....Corrosion-resistance prevents chemical attack inside tubes and permits the use of river or sea water as coolant. Includes heat transfer nonographs, tables, etc. in Catalog No. PE-8.
230-1e *Corning Glass Wks.

Coolers, Cascade.....Designed for cooling corrosive liquids and gases. Low initial cost and maintenance, radiused returns for low pressure drop as well as redwood waterguide strips. Request Catalog No. S-6820.
327e *National Carbon Co.

Freeze Dry Systems.....From the maker of the world's largest freeze dry systems . . . a new line of freeze dry units with new efficiency—ease of operation. Announces availability of Data Sheets on various models.
455 *Naresco Equipment Corp.

Furnaces, Multiple Hearth.....Thousands of Nichols Herreshoff & Bethlehem Wedge furnaces, custom built or standard design, all individually engineered, are now in worldwide operation. Complete literature.
309 *Nichols Engrg. & Research.

Generators, Steam.....16 p. book gives capacities, dimensions, construction features, instrumentation, accessories, sectional drawings & installation photos on new series of steam generators. Bulletin PG-55-3.
528C Foster Wheeler Corp.

Heat Exchangers.....Describes how equipment offers: chemical resistance to practically all corrosive fluids; resistance to severe thermal shock; high heat-transfer rates; low maintenance; etc. Catalog S-6740.
327e *National Carbon Co.

Heat Exchangers.....For corrosive or non-corrosive liquids and gases. Industrial builds these to suit the job and can furnish all auxiliary pumps, piping and fittings. Request Bulletin No. 600-2-354.
486f *Industrial Filter & Pump.

Heat Exchangers.....In De Laval plate heat exchangers the plates are so designed as to produce strong turbulence and high velocity . . . achieving maximum heat transfer. Request Plate Heat Exchanger Bulletin.
291 *De Laval Separator Co.

Heat Exchangers.....Open in 5 seconds with new p-k Lever-Lock Door. Savings seen for processors of high-fouling liquids & others who must clean & inspect heat exchangers regularly. Details in Bulletin No. 2030.
450 *Patterson-Kelley Co.

*See Explanation on Page 516

Heat Exchangers.....Pyrex brand glass shell and tube heat exchanger gives complete corrosion protection: nothing to corrode; compact; cleaning problems disappear; economical; etc. Request descriptive literature.
230-1a *Corning Glass Wks.

Heat Exchangers.....Covers complete line of Karbate brand impervious graphite shell & tube heat exchangers. Engineered for maximum corrosion resistance & minimum maintenance. Request Catalog Section S-6840.
327d *National Carbon Co.

Heaters, Electric.....Check Chromalox electric heat for your application. See F1550—"101 Ways to Apply Electric Heat." To get details about heaters for electroplating industry, request Bulletin No. 750.
416 *Edwin L. Wiegand Co.

Heaters, Fired Indirect.....For heating air; special atmospheres; corrosive & non-corrosive gases; thermal chemicals; circulating oils; asphalt; for super heating vapors & other exacting duties. Bulletin 551.
47 *Brown Fintube Co.

Heaters, Gradiation.....Tube life tripled . . . with Selas Zone Control. "Gradiation Heating for Petroluem and Chemical Processing" shows the use of Zone Control in many continuous processing applications.
451 *Selas Corp. of America.

Heaters, Unit.....Grid unit heaters feature trouble-free heating service in the major chemical plants for over 25 years—no maintenance or repairs. Get the full story in booklet, "Corrosion in Unit Heaters."
R525 *D. J. Murray Mfg. Co.

Heating, Steam, High Pressure.....Describes method completely utilizing both the sensible & latent heat of high pressure steam. Trustworthy, long lived equipment for heating or process. Bulletin No. 109.
529A Niagara Blower Co.

Traps, Steam.....Impulse steam traps offer valuable features: get equipment hot in a hurry—& keep it hot; good for all pressures without change of valve or seat; easy installation; etc. Request Trap Catalog.
25 *Yarnall-Waring Co.

Traps, Steam.....Larger valve orifice saves four ways: initial cost; upkeep expense; warm-up time; production time. Six types for every process, heat, power use. Complete information in Trap Catalog 953.
75 *W. H. Nicholson Co.

Instruments & Controls

Comparators.....Fully illustrated, 100 p. tells how to use pH and chlorine control for water supplies, process solutions, production processes in 34 basic industries. Also covers complete line of comparators.
L362 *W. A. Taylor & Co.

Control, Evaporator.....Company announces the availability of a literature reference covering the recommended instrumentation for multiple effect evaporators in great detail. Request copy of Data Sheet No. 10.
448 *Taylor Instrument Cos.

Control, Sequencing Timing.....Used in water treatment plants, chemical & food processing plants, & paper & textile mills to pace chemical feeders & other equipment. Details of systems in Data Sheet 11.12-1.
529B Minneapolis-Honeywell.

Control, Slurry Density.....Describes control of water percentage in wet process cement manufacture. Method of operation, design features, performance specifications, instrumentation, etc. Data Sheet 1.1-4.
529C Minneapolis-Honeywell.

*See Explanation on Page 516

Pick the Right Evaporator!

Here's how to evaporate light, low boiling point fractions of viscous mixtures.

The Whitlock Falling Film Evaporator is designed to do this job most economically and efficiently. It is accurately manufactured to rigid standards to assure the proper liquid distribution so important in the evaporating process . . . The tube ends are ground to precisely the same heights to provide uniform flow of the fluids in ALL the tubes. Whitlock engineering and fabricating techniques combine to produce an evaporator of unsurpassed performance.

Evaporators are only one Whitlock Product . . . we design and build *all* types of heat exchangers for the Processing Industry. Whatever your requirements, whether standard or special, you can depend on Whitlock's long experience. Write for recommendations and Bulletin 250. The Whitlock Manufacturing Company, 97 South Street, West Hartford 10, Connecticut. In Canada: Darling Brothers, Ltd., Montreal.

- **Evaporators of straight tube—fixed tube sheet design, incorporating standard Whitlock shell side expansion joints.**
- **Tube ends ground square with maximum elevation difference of ± .005".**
- **Distribution ferrules individually ground to inside diameter tolerance of + .001, — .000.**
- **Ferrules tangentially slotted in 3 positions provide proper liquid distribution.**

Whitlock

Designers and builders of bends, coils, condensers, coolers, heat exchangers, heaters, piping, pressure vessels, receivers, reboilers.

The very latest in

Package Type Plants

Producing

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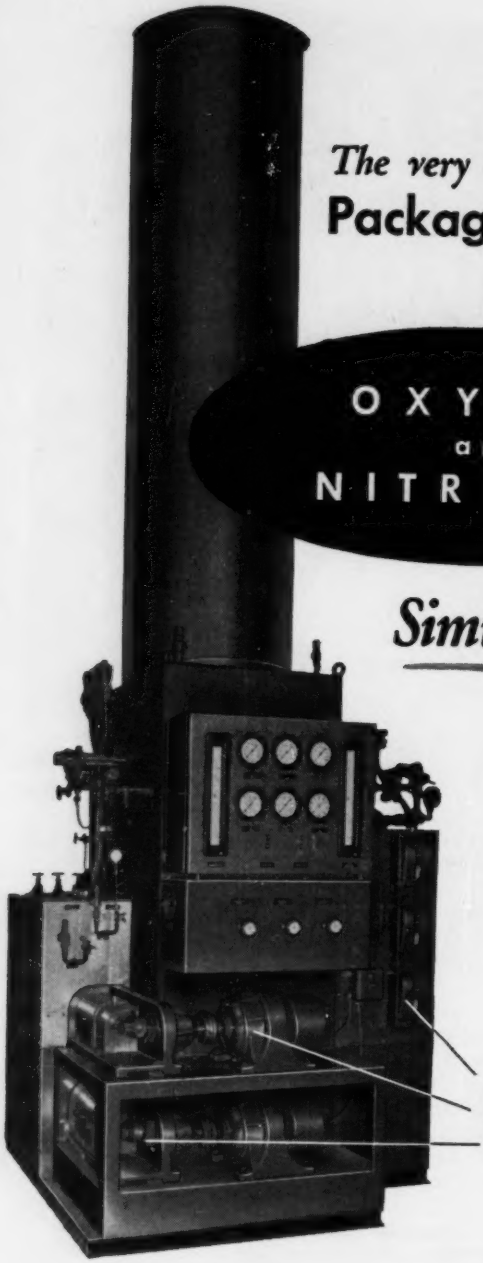

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LITERATURE . . .

Controllers, Input.....Describes Wheelco Inputrol—an automatic input controller for accurately controlling input rate of electrical power as well as flow of liquid or gas to any process. Bulletin F 5726-1.
530A Barber-Colman Co.

Controls, Electro-Pneumatic.....L&N's new C.A.T. (current-adjusting type) Control features: fast electrical response; simplicity, low cost, adaptability; easy installation; etc. Details in Folder No. ND4(8).
434 *Leeds & Northrup Co.

Controls, Photoelectric.....20 p. book, "Proved Answers to Successful Automation," offers specifications, descriptive data & operational charts of photoelectric controls for many industrial uses.
530B Electronics Corp. of America.

Controls Sizing.....BS&B's exclusive method takes both the "guess and the work" out of controls sizing . . . for liquid, steam and gas applications. For complete information, request company's illustrated Manual.
91 *Black, Sivalls & Bryson.

Controls, Temperature.....Describes application ideas & complete performance specifications for a new remote bulb, adjustable temperature controller. Gives sizes & various modifications. Brochure MC-121.
530C Fenwal, Inc.

Detectors, Fire.....Contains illustrations, technical data & power information about 2 new standard Fireye fire detection systems designed to protect warehouses, large storage or factory areas, etc. 7 p.
530D Electronics Corp. of America.

Gages.....For pressure, vacuum or compound service. There are no gears or teeth to wear out. Cam wiping action keeps contact points clean & smooth. Provides complete information in Gage Catalog No. G-2.
379 *Helicoid Gage Div.

Gages, Filter Plant.....Reference describes the various types of meters and includes facts on operation, construction, general information, sizes and capacities, specifications, etc. Request 20 p. Bulletin 1002.
530E Simplex Valve & Meter Co.

Gages, High Vacuum.....Outstanding among NRC's line of Thermocouple, Ionization, and Pirani Gages is Model 517 Alphatron. Ionization vacuum gage with a 10-4 to 1000 mm. Hg. range. Request Bulletin.
530F Naresco Equipment Corp.

Gages, Liquid Depth.....Presents comprehensive information on the operation and design of the Petrometer Series 1400 gages, as well as the method of selecting the right gage. Illustrated Bulletin 6004.
530G Liquidepth Indicators.

Gages, Liquid Level.....Presents valuable data on liquid level gages: reflex; thru vision; tubular. Standard equipment in leading refineries and industrial plants all over the world. Request complete Catalog.
R362 *Strahman Valves.

Gages, Pressure.....Important data on new Switch Model Mechanical Pressure Gage. Includes details of switch arrangement & ratings, pertinent dimensions & latest price schedules. See Bulletin No. PG-4.
530H W. C. Dillon & Co.

Gages, Tank.....Company makes available pertinent information on their line of 100% automatic Liquidometer tank gages for gaging liquids of all kinds. Gages are approved by the Underwriters' Laboratories.
TL541 *Liquidometer Corp.

Indicators, Sight Glass.....Visi-Flo line offers a trustworthy visible means of altering you as to rate of flow, viscosity, color of liquids, clarity & purity of product. Sizes, styles, details in Bulletin No. F-6.
158 *OPW Corp.

*See Explanation on Page 516

Instrumentation.....Dynalog instruments can be used with resistance, voltage, capacity, or inductive type primary elements to measure &/or control any process variable with great speed accuracy. Bulletin No. 427.
241 *Foxboro Co.

Instrumentation, Miniature.....Whenever you're planning graphic process control, plan to take advantage of the extra values built into the latest Tel-O-Set miniature instruments. New Bulletin No. 7202.
160-1 *Minneapolis-Honeywell

Measurement, Packaged Precision..... For complete and detailed information on SR-4 Device applications and instrumentation, request company's new product literature: Bulletins Nos. 4300, 4301, 4302, and 4306.
225 *Baldwin-Lima-Hamilton Corp.

Meters.....Type 316 stainless steel meter for corrosive liquids . . . is answer to many measurement problems in food, chemical, drug & industrial processing fields—it resists corrosion. Bulletin No. OG-406.
83 *Rockwell Mfg. Co.

Meters.....Handle more than 150 liquid chemicals & food ingredients. Sizes from 25 to 1000 gpm. Bronze construction. Feature excellent reputation for sustained accuracy & low maintenance. Data Book 566-R.
396 *Neptune Meter Co.

Meters.....XACTO meters are easily adapted with choice of dials & controls for changing needs to speed liquid handling operations & provide accurate accounting. Request descriptive product information.
TL525 *Bowser, Inc.

Meters, Electricontact.....Now—explosion-proof—a new Niagara electricontact meter . . . for automatically measuring and controlling liquids in hazardous atmospheres. Complete details in Bulletin No. 35.
382 *Buffalo Meter Co.

Meters, Flow.....Illustrated description of all features of electronic flow meter, including diagrams explaining construction & operation, transmission system, receiver, etc. See Publication No. 55-1074-222.
531A Hayes Corp.

Meters, Purge.....Reference describes advanced concept in metering small flows of liquids or gases. Includes models and accessories, with capacity charts and dimension drawings. Request Bulletin No. 135.
531B Brooks Rotameter Co.

Pilots, Control.....Leslie floatless level control pilots sense changes in liquid level that will help you maintain peak output. In addition, you save on maintenance costs. Details contained in Bulletin 5303.
465 *Leslie Co.

Positioners, Valve.....Describes Wheelco Throttitrol—an automatic valve positioner for use in conjunction with any control instrument having a "high" & "low" contact with a neutral position. Bulletin F-5991-1.
531C Barber-Colman Co.

Potentiometers.....Provides complete information on single, double & triple range portable potentiometers. Lists instrument features & tabulates characteristics of each potentiometer. Data Sheet No. E-51(2).
531D Leeds & Northrup Co.

Radiography, Gamma.....12 p. presents basic data required for setting up & operating a gamma-radiography installation; tells how to select proper radioisotope; covers principles of radiation safety. Illustrated.
531E Technical Operations.

Receivers, Metagraphic.....Features a new degree of performance, flexibility, & ease of servicing in a pneumatic receiver. Bristol's line gives you 35 models to choose from. Request detailed Bulletin.
88-9 *Bristol Co.

*See Explanation on Page 516

Recorders.....Offer valuable features: pre-calibrated plug-in receiver units; up to 4 pneumatic or electronic receivers—or 2 receivers & 2 integrators; etc. Product Spec. E12-5 & actual chart sample on request.
54 *Bailey Meter Co.

Recorders, Potentiometer.....Due to demand for a truly portable indicating recorder, company redesigns standard recorder without sacrificing accuracy, sensitivity or durability. Request Catalog Section 60-100.
538 *Thermo Elec. Co.

Recorders, Temperature.....Newly designed Model "1000" Auto-Lite recorder gives permanent proof of temperature behavior. Request valuable catalog describing the many styles of recorders and indicators.
T336 *Electric Auto-Lite Co.

Regulators.....Describes Stabiline automatic voltage regulators (Type IE instantaneous electronic—Type EM electro mechanical) for increased efficiency, peak performance & lower costs. Bulletin No. S-351.
445 *Superior Elec. Co.

Spectrographs.....New model 3-Meter Concave Grating Spectrograph provides wavelength coverage in a single exposure which is double that of previous models. Operating details & specifications in Bulletin 52.
531F Baird Associates.

Spectrographs, Vacuum.....Detailed Catalog describes the Hilger Vacuum Spectrograph . . . for emmission and absorption spectroscopy at wave lengths shorter than the transmission limit of the atmosphere.
531G Jarrell-Ash Co.

Spectrometers.....Now — two process-monitoring mass spectrometers . . . for monitoring & controlling streams to mass 80 — for higher resolving power & readings to mass 150. Bulletin CEC 1824A-X28.
390 *Consolidated Engrg. Corp.

Spectrophotometers.....For instruments that are flexible, accurate & have a high degree of reliability—specify Cary. Outline of Cary spectrophotometers & description of other instruments in Bulletin AS-1.
531H Applied Physics Corp.

Telescopes, Industrial.....A.C.M.I. Borescopes permit close-up visual examination of interior areas & surfaces not otherwise visible. They save time & money & prevent costly dismantling. Request Booklet.
BR539 *American Cystoscope Makers.

Transmitters, H/P Differential Pressure.....Fully illustrated & diagrammed, 8 p. describes the principle of operation and gives dimensions, performance data & design specifications. Request Bulletin No. 1102.
531I Moore Products Co.

Pipe, Fittings, Valves

Couplings.....Steelflex couplings offer unique multiple protection for connected machinery—overcome damaging conditions of shock loads, shaft misalignment and vibration. Engineering Bulletin covers details.
59 *Falk Corp.

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Fittings, Forged Steel.....Wherever strong, tough pipe joints are needed . . . Watson Stillman forged steel fittings provide a safety factor against costly piping failures. Details in Bulletin No. A3-50.
427 *Watson-Stillman Fittings.

Fittings, Hose.....Catalogs give detailed information on hose for low pressure service & brass re-usable fittings. Describes the 3 body types of hose which are available. Request Catalog Files 4480A & 4484A.
531J Parker Appliance Co.

Fittings, Pipe.....Presents newest catalogue of stainless steel pipe fittings which shows all standard pipe fittings and flanges, flanged fittings, butt weld fittings, etc. Request fully illustrated Catalog No. 653.
381b *Camco Products.

Fittings, Stainless Steel.....Company announces the availability upon request of a complete stainless steel fittings catalog giving engineering drawings, dimensions and basic material data. Catalog No. 55F.
174b *Cooper Alloy Corp.

Fittings, Stainless Steel.....Offer entirely new concept of fitting design & fabrication—much greater speed & ease of installation—savings in original investment cost—etc. Details in new Bulletin No. 1055.
323 *Tri-Clover Div.

Flange Specifications.....Company announces the development of a new Flange Specification table for ASA and MSS Flanges in a convenient, slide rule form. Pocket-size reference is available upon request.
381a *Camco Products.

Hose, Flexible.....Describes design, installation & purchase of flexible hose used in dust & fume control, air conditioning & materials handling. Includes accessories & application. Bulletins 40, 41, 42, 43 & 44.
531K Flexaust Co.

Hose, Metal, Flexible.....Ideal for difficult fluid and gas handling jobs. Durable and leak-proof for conveying, controlling movement and vibration, correcting misalignments, etc. Full details in Bulletin No. 20D.
62 *Atlantic Metal Hose Co.

Hose, Metal, Flexible.....Describes & gives specifications for flexible metal hose & Flexon corrugated expansion joints. Contains data on application & construction, anchoring & guiding. Catalog No. 149.
531L Flexonics Corp.

Joints & Couplings.....Teflon expansion joints and flexible couplings absorb shock, vibration, thermal expansion and contraction. Connect unlike piping ends and nozzles. Covers complete data in Bulletin FC-952.
401 *U. S. Gasket Co.

Nozzles, Spray.....Company provides a 48 p. industrial catalog with full data on thousands of standard and special nozzles—for every type of spraying. Also information on related equipment. Catalog No. 24.
TR 539 *Spraying Systems Co.

Nozzles, Spray.....20 p. booklet, "Yarway Spray Nozzles" offers full description of product line, application data, capacity charts, dimension tables, etc. "Recooling Water in Spray Ponds" also available.
531M Yarnall-Waring Co.

Pipe & Fittings.....For corrosion-resistant piping. Impervious graphite pipe & fittings readily installed, long lasting, easily maintained, unaffected by most corrosive fluids. Request Catalog No. S-7000.
327b *National Carbon Co.

Pipe & Fittings, Glass.....Company announces the availability of their Pyrex Pipe Catalog describing product line of pipe and fittings, including spacers, adjustable joints, traps and adapter connections.
230-1b *Corning Glass Wks.

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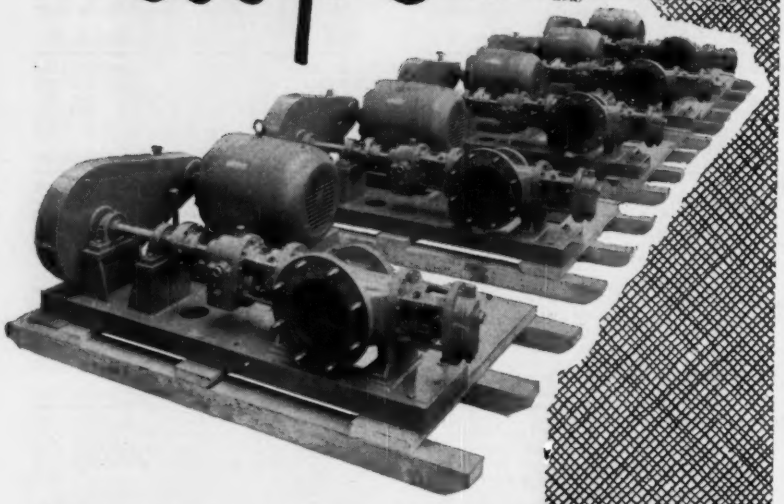

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LITERATURE . . .

Pipe, Plastic.....Republic Semi-Rigid Kralastic proves ideal for many applications in food processing & chemical industries. Extremely tough, it will absorb punishment without breaking. Complete information.
76a *Republic Steel Corp.

Piping.....“True Piping Economy” compares wrought iron & other types of pipe in terms of the 3 important costs to consider in buying pipe: initial purchase cost; cost of installation; cost of maintenance.
532A A. M. Byers Co.

Tubing, Flexible.....Hundreds of applications in the steam and Diesel power fields are filled by Penflex flexible tubing. For complete information on product line, request copy of “Flexineering” booklet.
480 *Pa. Flexible Metallic Tubing.

Tubing & Pipe.....Describes super-corrosion resistant tubing and pipe in alloys known as “B” and “C.” Resistance of both grades to common strong corrodents is covered in complete detail. T. D. No. 117.
532B Carpenter Steel Co.

Tubing & Pipe, Stainless.....Literature contains tables of analyses, mechanical properties, creep strength, physical properties, oxidation resistance of 9 of most popular stainless tubing steels. Folder TB-355.
532C Babcock & Wilcox Co.

Tubing & Pipe, Stainless.....For information on corrosion resistance, properties, performance results, uses, and fabrication of Carpenter Stainless No. 20 and No. 20Cb, request copy of Bulletin 108A.
477 *Carpenter Steel Co.

Unions, Forged Steel.....After quick & easy installations, even in roughest spots, Orifice Unions will perform superbly in measuring, mixing, blending, strainer or blanking off services. Offers new Catalog.
BL488 *Clayton Mark & Co.

Valves.....Tube Line valves up to 4000 psi eliminate pipe threading . . . seal welding . . . & every joint is a union. Easy & fast assembly in lines win preference for valves in many industries. Bulletin No. 255.
417 *Autoclave Engrs.

Valves.....For heavy duty or special duty, McNally valves give accurate control & long life. Standard line includes: abrasion resistant, gate, motorized gate, cock, special, etc. valves. Detailed Bulletins.
394a *McNally Pittsburg Mfg. Corp.

Valves.....Fully illustrated with photographs, charts and diagrams, 8 p. reference describes operating data, principles of operation and typical installations of Greenwood valves. Request Bulletin No. GV-11.
532D Vernon Tool Co.

Valves.....Illustrates & describes SK's line of valves. Includes data on designs & their specific advantages & details of construction & application. Control & testing facilities also covered. Bulletin V-1.
532E Schutte & Koerting Co.

Valves, Bronze.....Greater operating safety, positive shutoff, & low upkeep costs are prime advantages of modern OIC bronze gate valve designs in all pressure classes. Full details in Folder No. 1006.
61 *Ohio Injector Co.

Valves, Check.....Fast, quiet operation means low cost operation for check valves . . . and that's exactly what the Chapman Tilting Disc Check Valve is designed to do. Data on full line in Catalog No. 30-A.
454 *Chapman Valve Mfg. Co.

Valves, Check.....When used with tanks, dry cans, retorts & pressure vessels of all kinds, the Durabla check valve unit is the lowest cost, high-quality valve you can purchase. Full details in Bulletin CE-115.
548 *Durabla Mfg. Co.

*See Explanation on Page 516

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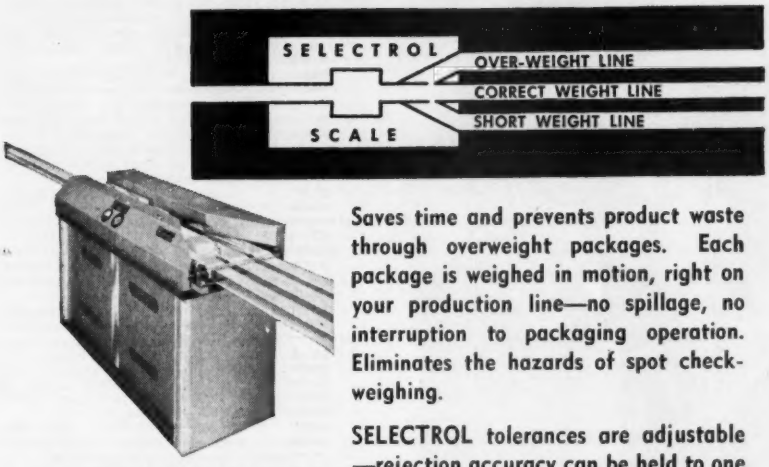

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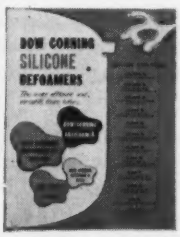

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LITERATURE . . .

Valves, Diaphragm.....From antibiotics to the toughest acids, alkalis and salts, there is a combination of Hills-McCanna body and diaphragm materials that will best suit your needs. Request Folder.
528 *Hills-McCanna Co.

Valves & Fittings, Plastic.....New corrosion-resistant valves & pipe fittings are molded of rigid polyvinyl chloride. A brochure explaining complete Walworth PVC product story is now available upon request.
333 *Walworth Co.

Valves, Globe.....Completely illustrated Circular describes the new LQ600 valve . . . the first bronze globe valve with Brinalloy seats and discs. Gives all features and a list of suggested applications.
534A Lunkenheimer Co.

Valves, Lubricated Plug.....28 p. catalog shows straightway, 3-way, 4-way, & multiple port lubricated plug valves for 250 lbs. oil-water-gas & 150 lbs. steam working pressure. Reference Book 39—Section 5.
443 *Homestead Valve Mfg. Co.

Valves, Plug.....No funnel action . . . because both ACF regular round & ACF rectangular port valves have port areas at least equal to the pipe itself. For complete details of features, see Catalog No. 5.
273 *ACF Industries.

Valves, Plug.....Regrind-renew plug type valves with 500 Brinell armor seat—armored against valve-killing close control of steam . . . and abrasion. For complete information on company line, request Form No. 202.
413 *Jenkins Bros.

Valves, Reducing, High Pressure..... Includes photos, a cross-sectional engineering drawing, recommended uses, description of construction & operation features, capacity, rating & sizing charts. Bulletin S-731.
534B A. W. Cash Co.

Valves, Solenoid.....Choose rugged industrial type Davis solenoid valves . . . for less downtime—less maintenance—more reliable control. For complete details of features, request copy of Bulletin 700.
R523 *Davis Regulator Co.

Valves, Solenoid.....New ASCO 2-way solenoid valve with explosion-proof enclosure—designed to meet NEMA VII & UL requirements—offers safe, automatic control. "Solenoid Valves for Corrosive Applications."
87 *Automatic Switch Co.

Valves, Solenoid.....Fully illustrated, 52 p. describes the complete line of Skinner solenoid valves. Includes general specifications, principles of operation, flow rate charts, etc. Request Catalog No. D1.
534C Skinner Elec. Valve Div.

Valves, Solenoid.....Illustrates and describes a complete line of electrically controlled magnetic valves. Includes data on application, construction, operation, specifications, etc. Magnatrol Catalog.
534D Magnatrol Valve Corp.

Valves, Stainless Steel.....Announces availability of a 68 p. simplified stainless steel valve catalog which includes engineering drawings, wts., size ranges, dimensions & basic material data. Catalog No. 55D.
174a *Cooper Alloy Corp.

Process Equipment

Absorbers.....For absorption of hydrogen chloride and other gases. Produce as much as 20 tons per day 22° Baume acid. Pneumatic automatic control. Complete information offered in Catalog No. S-7460.
327f *National Carbon Co.

*See Explanation on Page 516

Agitators, Fluid, Packaged.....Offers a new line of packaged fluid agitators . . . plus complete fluid agitation engineering service . . . plus field service—right in your plant . . . etc. Illustrated Bulletin.
457 *Philadelphia Gear Wks.

Caps, Bubble.....Standard reference on bubble caps and risers contains complete specification information for hundreds of variations . . . the largest compilation of engineering data. Request Bulletin No. 22.
T334 *Pressed Steel Co.

Centrifugals, Center-Slung.....When your process calls for liquid-solids separation by centrifugal force . . . you can do it more economically with the new Tolhurst Center-Slung centrifugal. Descriptive Catalog.
374 *American Mach. & Metals.

Centrifuges.....Provides industry with 7 types of continuous centrifuges to handle materials ranging from 2 immiscible liquids to crystalline solids. Briefly & graphically describes full line in Bulletin No. 1259.
129 *Sharples Corp.

Cleaners, Air.....New high efficiency engine intake air cleaner meets the lower allowable intake resistance demanded with the use of turbochargers & pressure blowers for scavenging. Bulletin No. 160.
84-5i *American Air Filter Co.

Cleaning, Air.....Buffalo equipment includes air washers, hydraulic scrubbing towers, hydro-volute scrubbers, rotary multi-stage gas scrubbers, etc. Bulletins AP-225, AP-425, AP-525, 3181-B & 2424-F.
50a *Buffalo Forge Co.

Closing Devices.....New Sperry Handraulic closing device—easiest to install & operate—brings filtration economy to new or existing filter presses. Booklet covers simple erection & operating directions.
430 *D. R. Sperry & Co.

Cloth, Filter.....If high operating temperatures are your problem . . . try NFM cloth made from Orlon acrylic fiber. Makes available detailed literature on its important values plus a product sample.
545a *National Filter Media Corp.

Cloth, Filter.....Literature reference, "Facts and Figures About Filter Cloth" contains actual samples and performance characteristics on Stanley corrosion-resistant filter cloth. Copies available on request.
B336 *W. W. Stanley Co.

Columns, Fractionating.....Give you maximum chemical stability, high resistance to thermal and physical shock; lets you see the fluids in process. For complete product information, request detailed Data Sheet.
230-1d *Corning Glass Wks.

Crushers, Jaw.....Cast steel frame, manganese jaw & cheek plates. Large diameter shafts reduce shaft deflection & thus increase life of heavy-duty, oversize roller bearings in bumper. Bulletin No. C12-B12.
361d *Denver Equipment Co.

Dissociators, Ammonia.....Illustrated, 12 p. offers valuable information: typical uses of dissociated ammonia; description of dissociator; economy; advantages; sizes-capacities; users of equipment; etc. Bulletin B-52.
53 *Drever Co.

Dryers.....Available in several types; direct heat, indirect heat, and steam tube. Let Deco engineers help solve your drying problem—no dryer problem too small or too large. Details in Bulletin No. D4-B2.
361j *Denver Equipment Co.

Dryers.....Lectro-dryers can dry air & gases in volume to dewpoints below —100°F—can drop relative humidity lower than 10%. Booklet describes machines & how various industries use them to gain efficiency.
90 *Pittsburgh Lectrodryer Corp.

*See Explanation on Page 516

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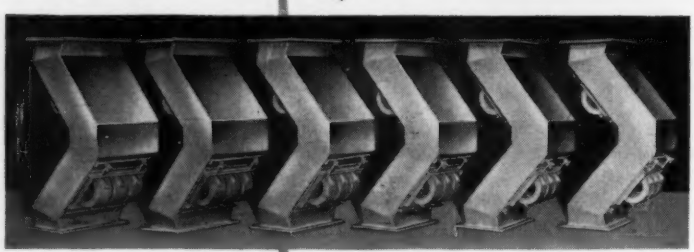

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536A Blaw-Knox Co.

Dust Collectors.....Describes the type "CW-1" centrifugal wet dust collector. Contains photos, line drawings, tables and complete data on the countercurrent, wet collector of tower construction. Bulletin 919.
536B Pangborn Corp.

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84-5a *American Air Filter Co.

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386 *Pangborn Corp.

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325 *Rodney Hunt Mach. Co.

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476 *Wellington Sears

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93 *R. P. Adams Co.

Filters.....Describes Denver disc, drum & laboratory filters. Contains photos of actual installation, drawings & specifications of machines, & facts about construction & operation. Bulletin No. FG-B1.
537A Denver Equipment Co.

Filters.....Illustrated brochure describes double duty filters for: electroplating; chemical processing; pharmaceuticals; food & beverages; paints & varnish; etc. Includes features and specification data.
537B Bare-Messing Corp.

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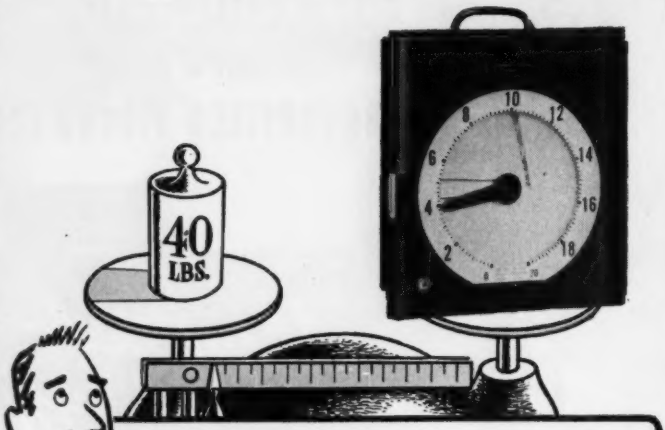

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Filters, Water.....A complete description of standard sizes of water filters, for use with filter-aid to handle 8 gpm to 939 gpm, with typical flow sheet contained in detailed bulletin. Release No. 214 upon request.
538A Micro Metallic Corp.

Flakers.....Stokes flaker replaces batch method in the processing of moth-killing chemical. Full details of laboratory and advisory service for solution of production problems are covered in Bulletin No. 640.
98 *F. J. Stokes Mach. Co.

High Pressure Equipment.....Illustrated, 28 p. describes rapidly expanding line of high pressure valves, adaptors, reactors, autoclaves, thermocouplings, gages, fittings & tubing. Request Catalog No. 2055.
538B High Pressure Equipment Co.

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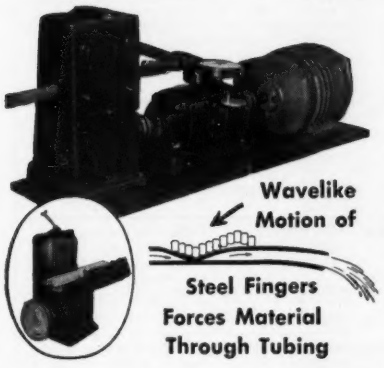

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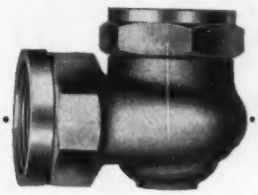

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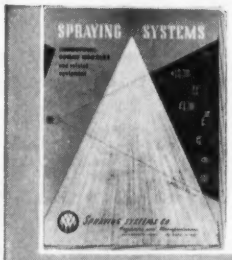

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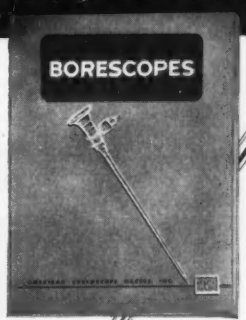

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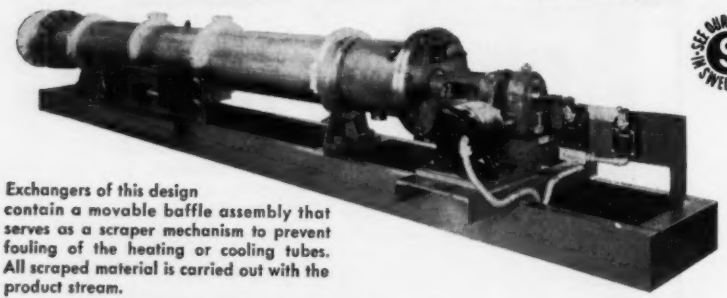

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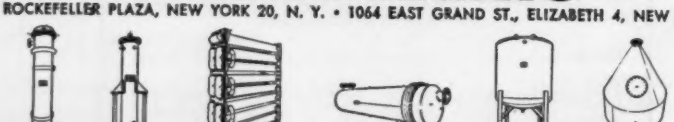

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423e *International Engrg.

Mixers.....Company makes available Confidential Mixing Data Sheet. Helpful checklist enables you to develop a complete technical description of agitation required for your process, quickly & easily. No. B-107.
123f *Mixing Equipment Co.

Mixers, Dry.....Describes conical blenders (design, operation, application, capacity, sizes & specifications) & ribbon mixers (operating & construction features, specifications, etc.). Illustrated Bulletin No. 78.
423b *International Engrg.

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163a *Sprout-Waldron.

Mixers, Side Entering.....The Type "NU" side entrance mixer is a brand new unique mixer design. It has no cast parts and is of all welded construction, including the stuffing box. Illustrated Bulletin No. 72-A.
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123e *Mixing Equipment Co.

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123c *Mixing Equipment Co.

Mixers, Top Entering.....Information on top entering propeller mixers. Includes data on selection, construction features, sizes & specifications of high & slow speed top entrance mixers, etc. Bulletin No. 73.
423d *International Engrg.

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123d *Mixing Equipment Co.

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527a *Hardinge Co.

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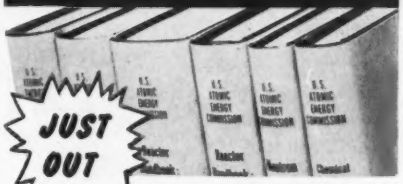

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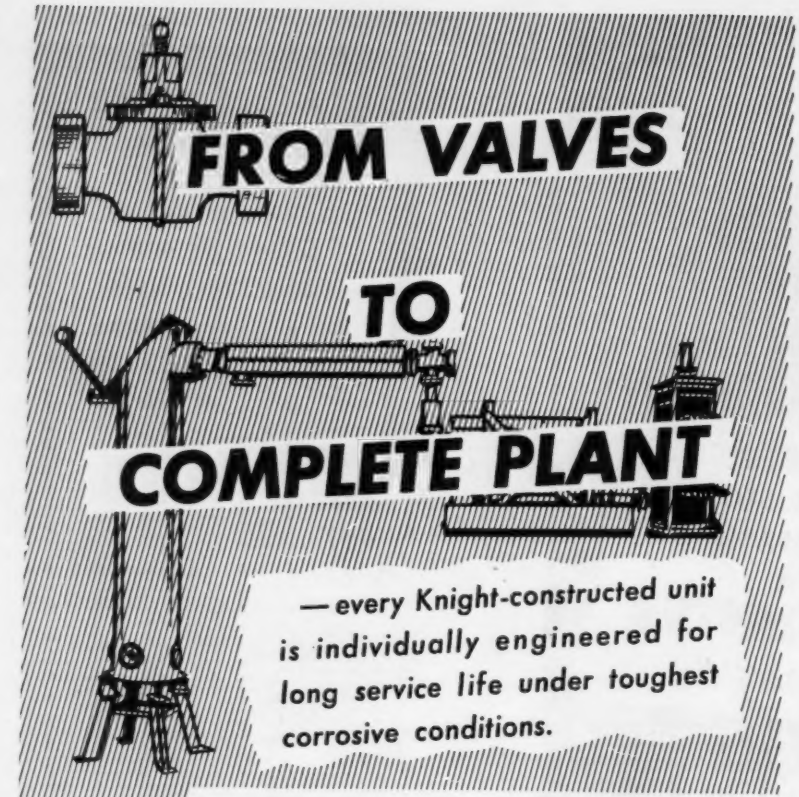
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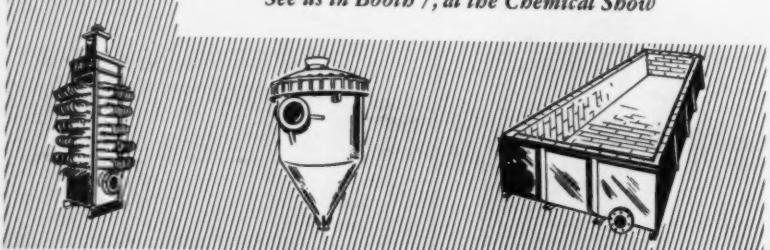

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558a *Pfaudler Co.

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542A Joy Mfg. Co.

Screens, Wire.....Wire screens for vibrators are serving faithfully in daily operations in the major coal and mining centers of the world. Offers complete information on product line in Bulletins Nos. 5, 6, and 7.
BL523a *Cleveland Wire Cloth & Mfg.

Strainers.....Contains photographs, descriptions, dimensions, capacities, installations and pertinent engineering information on automatic, manual and twin basket strainers. Request Bulletins 500-1-2-3-4-5-6-10-15.
542B S. P. Kinney Engrs.

Trays, Bubble.....Glitsch "Truss-Type" bubble trays serve all processing plants . . . chemical—petro-chemical—natural gasoline—petroleum refining—AEC—etc. For details, request Technical Bulletin.
384a *Fritz W. Glitsch & Sons.

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BL533 *R. D. Cole Mfg. Co.

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84-5e *American Air Filter Co.

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486g *Industrial Filter & Pump.

Wire Cloth.....84 p. catalog describes company's facilities for fabricating wire cloth parts. Includes wire cloth parts for screening, filtering and special uses. Also provides helpful metallurgical information.
400 *Cambridge Wire Cloth Co.

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549 *Newark Wire Cloth Co.

Wire Cloth.....Produces standard replacement or custom-designed filter leaves or units, strainers, screens, trays, baskets, cylinders, semi- or complete process apparatus of any desired metal. Catalog No. 50.
308a *Multi-Metal Wire Cloth Co.

Pumps, Blowers, Compressors

Blowers, Motor.....Describes blowers in 2 series up to 4" static presure. Available in 1, 2 & 3 fan assemblies. Applicable to ventilating, drying, air conditioning. For details, request Bulletin No. 89.
542C Niagara Blower Co.

*See Explanation on Page 516

Compressors.....Engineered for continuous, heavy-duty usage, the Class O Compressor affords complete dependability with low operating cost. Require minimum attention & upkeep. Full information in Bulletin 726.
474 *Chicago Pneumatic Tool Co.

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7 *Joy Mfg. Co.

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514 *Norwalk Co.

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466 *Cooper-Bessemer Corp.

Fans, Vaneaxial.....Illustrated, 16 p. describes Series 1000 Axivane adjustable blade, vaneaxial fans for commercial & industrial applications. Covers design, features, specifications, etc. Bulletin No. J-611.
543A Joy Mfg. Co.

Pumps.....Buffalo 2-stage Type RR Pump for clear water at high pressures, any temperatures. Widely and successfully used on boiler feed for many years. For complete information, request Bulletin No. 980.
522 *Buffalo Pumps.

Pumps.....Handle most anything that can pass thru a pipe, from free-flowing liquids to non-pourable pastes—even materials containing relatively large particles or abrasives. Moyno Pump Bulletin No. 30-B.
461 *Robbins & Myers.

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543B Ingersoll-Rand Co.

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327a *National Carbon Co.

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261 *LaBour Co.

Pumps, Centrifugal.....Specially designed rubber lined pumps for corrosion abrasion resistance. Only a cutaway model can show the many features that spell long life & low maintenance. Request Bulletin 300.
486d *Industrial Filter & Pump.

*See Explanation on Page 516

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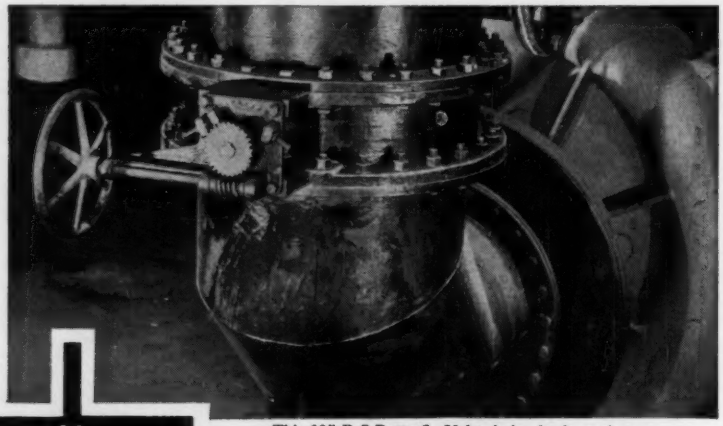

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544A Denver Equipment Co.

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42 *Aldrich Pump Co.

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517 *Kinney Mfg. Div.

Pumps, Piston-Diaphragm.....For controlled-volume pumping of fluids. Flow-charts, typical applications, description & specifications of models of various capacities & constructions, in Bulletin No. 440.
93 *Lapp Insulator Co.

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BL525 *Viking Pump Co.

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133 *Foster Wheeler Corp.

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551 *Willson Products.

*See Explanation on Page 516

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152-3 *General Precision Equip. Corp.

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545E National Safety Council.

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545H Foster Wheeler Corp.

*See Explanation on Page 516

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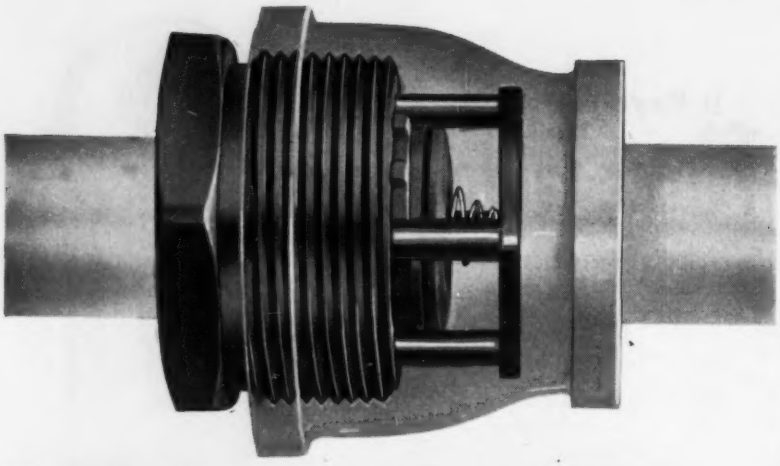

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- *Cut inventory—drastically*
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- *Be ready for any check valve emergency*

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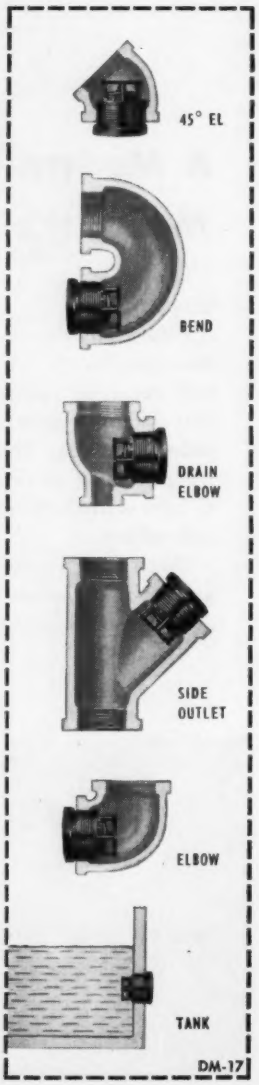

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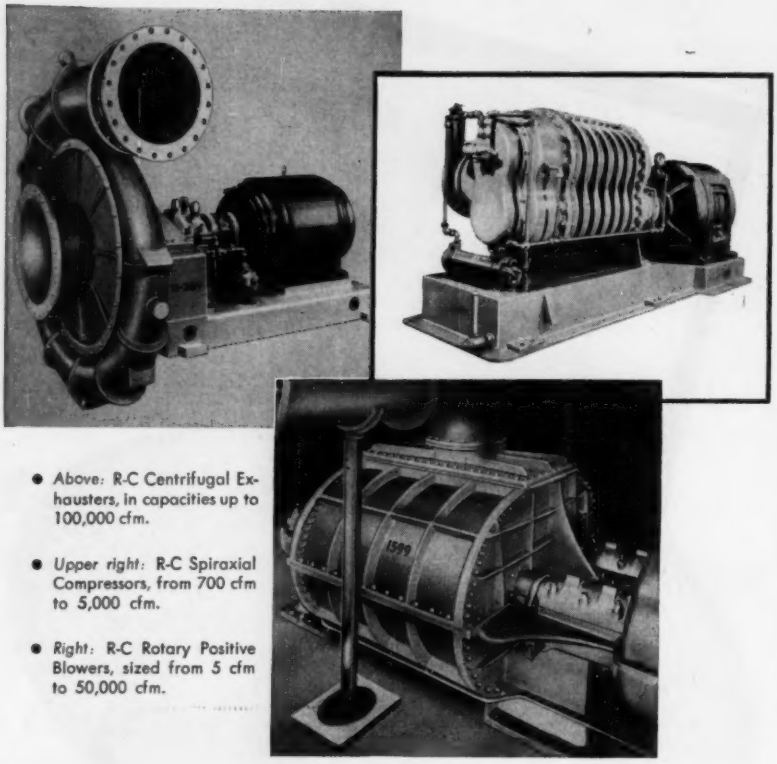

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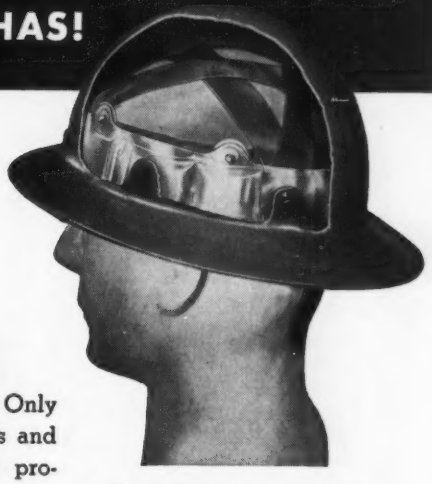

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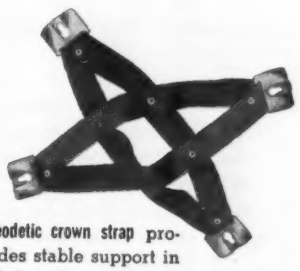

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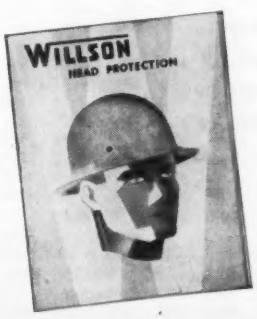

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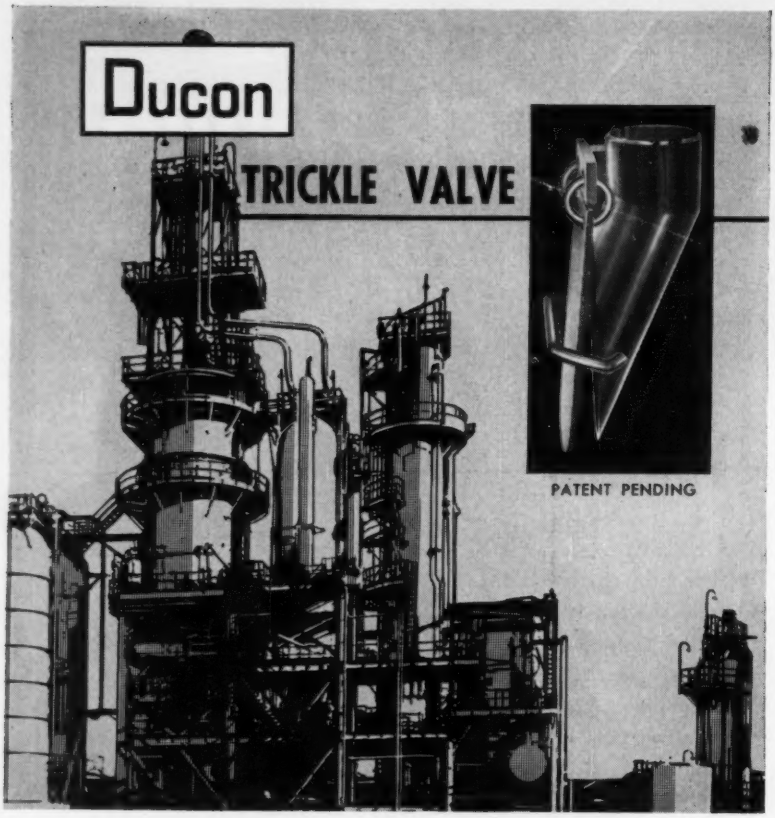

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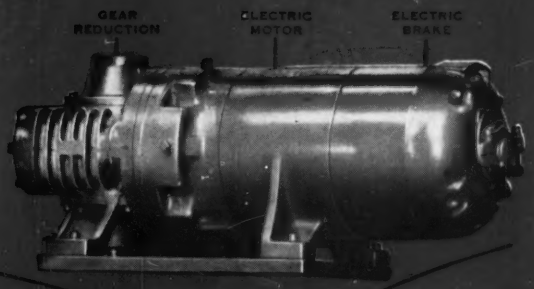

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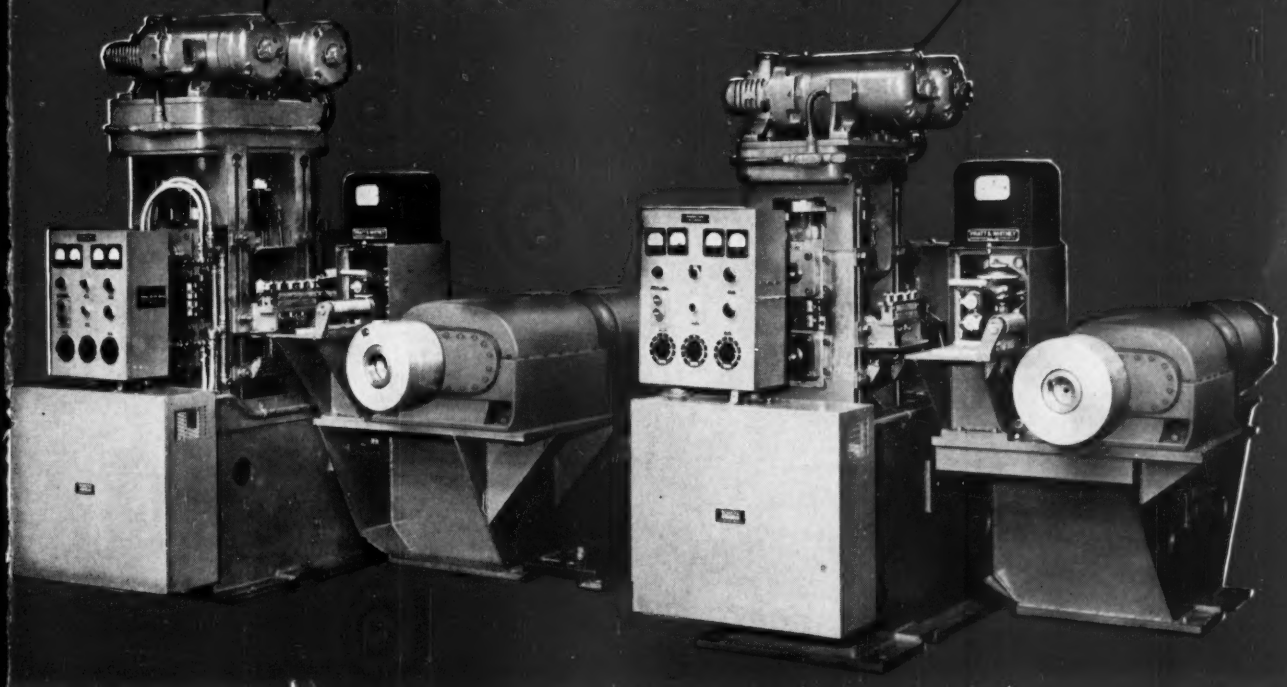


Corrosioneering News

Quick facts about the services and equipment Pfaudler offers to help you reduce corrosion and processing cost.

WORLD PREMIERE . . .

1955 Chemical Show sees debut of several New Achievements in Glassed Steel Construction

No contamination, no leakage with new seal for reactors

No metallic contamination of your product. No stray, unwanted catalysts. No escaping vapors.

These are the advantages of a new nonmetallic rotary Crane-type seal now available on Pfaudler glassed or stainless steel reactors up to 100 gallons. (A similar design is also available for larger units.)

Only Pfaudler glass, Teflon, ceramic and carbon come into contact with your product. Design of the seal is simple, easily maintained.

New development boosts corrosion resistance of columns

Better results from fractionation and other processes requiring a column are now possible with the added corrosion resistance of a new Pfaudler development.

It's a glassed steel distributor plate, available for all size columns. Using Pfaudler acid-alkali-resistant glass, this plate provides complete flexibility of use over a range up to pH 12 at 212° F.

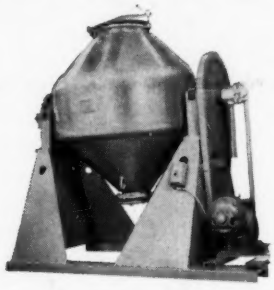
The corrosion resistance of this glass protects product purity, simplifies cleaning, and protects your equipment investment.

Dryer-blender tumbles out 4 days' work in 7 hours

In actual use, a Pfaudler glassed steel conical dryer-blender is producing as much dried product in 7 hours as formerly required at least 4 working days, using a different type of dryer.

Double-cone shape, tumbling action and efficient heating design are responsible for this great speed. In addition, a broad range of corrosive applications is possible, because the unit is fabricated of Pfaudler's special acid-alkali-resistant glassed steel.

To pre-test your product in the



Pfaudler dryer-blender, a small 2'-diameter test model is available. You'll see it at the Chem Show – or write us for full details.

New Pfaudler hydraulic drive and seal

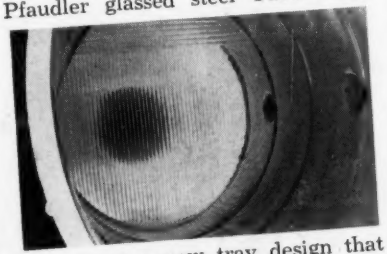
The new Pfaudler hydraulic drive and seal offers many advantages: It can be made in both stainless steel and glassed steel construction for a large range of reactor sizes and for greater horsepower requirements with either hydraulic or air motors.

Any noncorrosive fluid can be used as a seal – even one of the ingredients of your own product – providing you 100% protection against contamination.

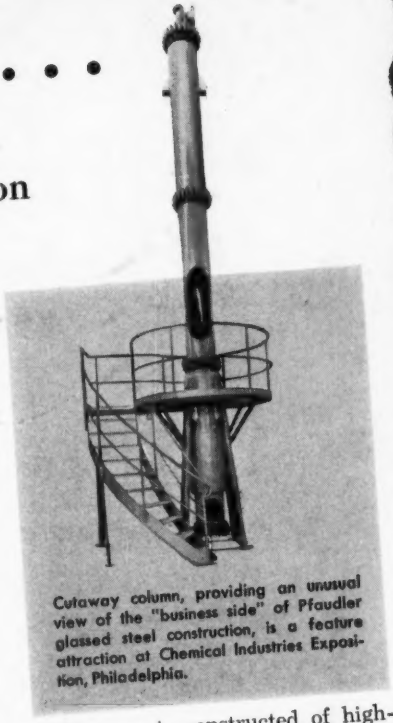
This seal is operated under pressure, requires a minimum of maintenance, and is designed to give years of trouble-free service. Your Pfaudler representative can provide full details at your request.

New turbo-grid tray gives higher yield at lower cost

You're looking down the throat of a Pfaudler glassed steel Turbo-Grid



column, at a new tray design that provides enormously high capacities, yet lowers the cost of the column itself.



Cutaway column, providing an unusual view of the "business side" of Pfaudler glassed steel construction, is a feature attraction at Chemical Industries Exposition, Philadelphia.

The tray is constructed of high-strength PYREX brand glass tubes, with all their inherent advantages of corrosion resistance, physical toughness, and thermal shock resistance.

Because of the high capacity resulting from this design, the column itself can be of smaller diameter than previously required – an important means of cutting its cost.

Now—variable agitator speeds ranging from 60 to 340 RPM

Six different agitator speeds: 60, 90, 120, 175, 250, and 340 RPM are now available on Pfaudler reactors up to 100 gallons.

These are made possible by interchangeable constant-speed sheaves of the new PW drive. As an alternative, variable pitch sheaves may be supplied, giving quick adjustment for *all* speeds ranging from 60 to 300 RPM.

The new PW drive rides high above the top head of the reactor, out of the way so you can have easy access to other nozzles.

Write for Bulletin 923.

Pfaudler

THE PFAUDLER CO., ROCHESTER 3, N. Y.